

12 Woodworking Shortcuts for Your Shop — page 162

POPULAR MECHANICS

DEC. 1966
35 CENTS

**BUILD PM'S
WALT DISNEY
CHRISTMAS TREE**

page 69



Fred MacMurray, star of Walt Disney's new movie, 'Follow Me, Boys!' hangs Mickey Mouse on Christmas mobile.

CARS — Dan Gurney — Saturday Mechanic — ABCs of Carburetion

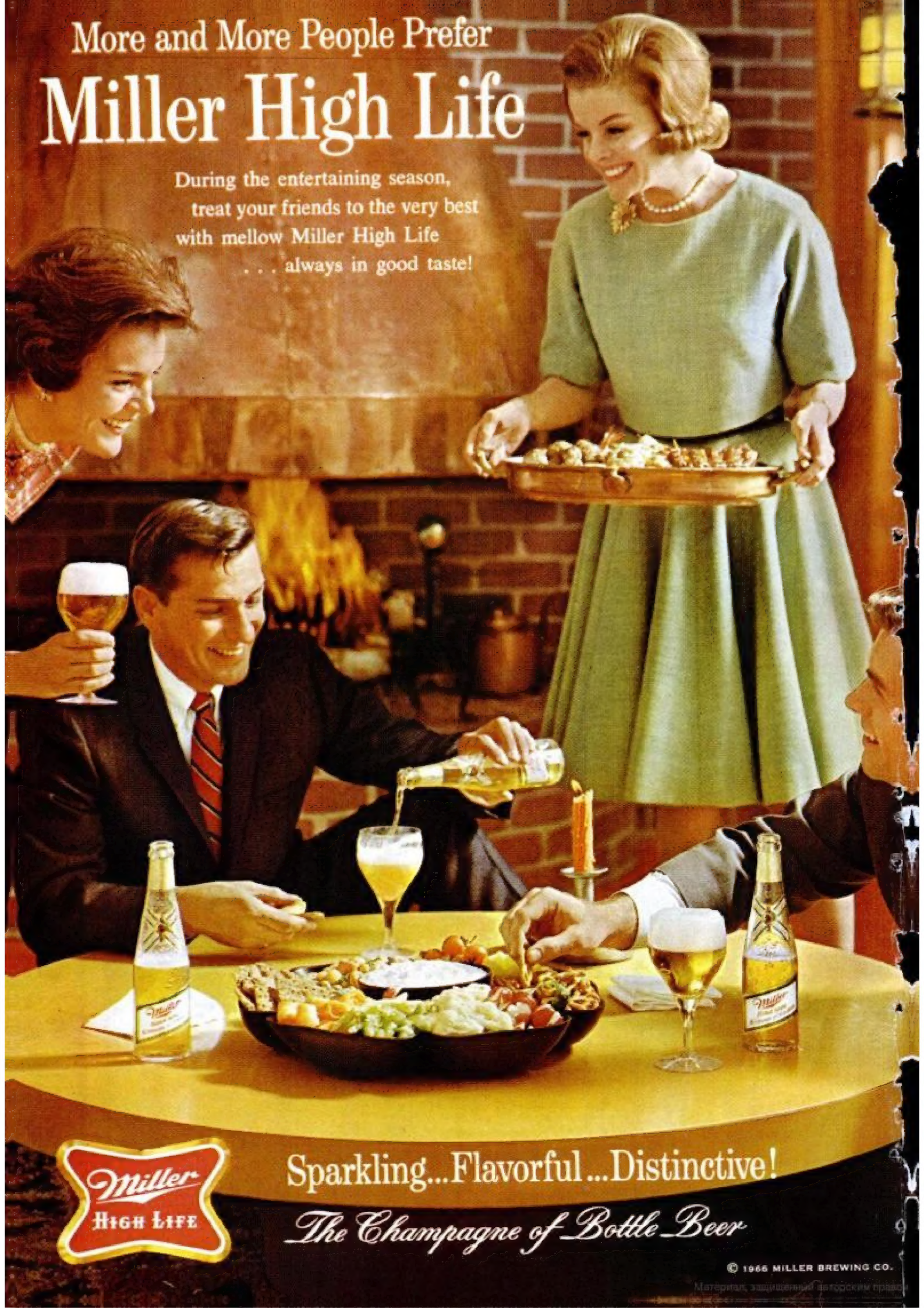
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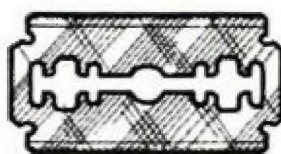
Norelco introduces the Tripleheader.



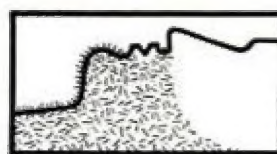
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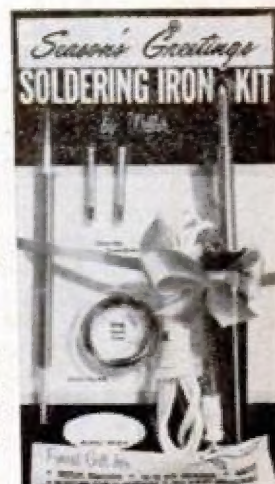
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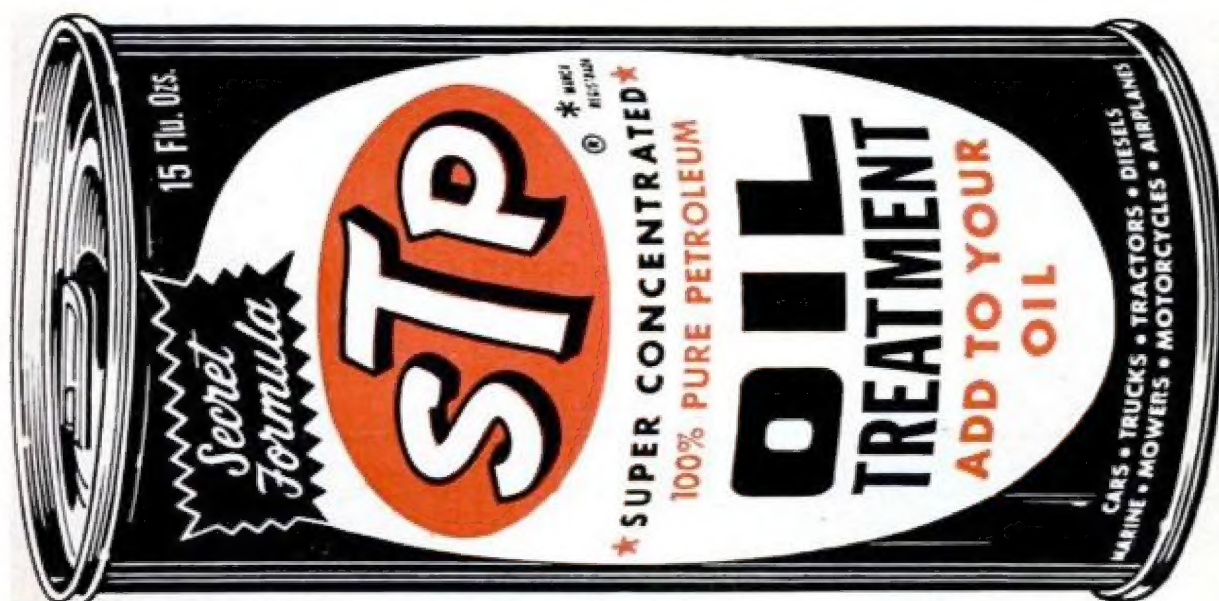


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AUTOMOBILES AND DRIVING

- [42 Detroit Listening Post](#)
- [62 Auto Clinic](#)
- [74 Drivin' with Dan—Dan Gurney](#)
Answers Readers' Questions
- [88 High Explosives on the Highways](#)
- [98 A Bolder Barracuda](#)
- [120 The ABCs of Carburetion](#)
- [166 Saturday Mechanic: How to Live With Your Muffler](#) (Flagged for filing)

SCIENCE AND INVENTIONS

- [12 Science Worldwide](#)
- [76 Where Even Santa Gets Ideas](#)
- [94 Brain Surgery by Computer](#)
- [102 An Expert's Blueprint for Successful Inventing](#)
- [110 The Giant Stage that Shifts for Itself](#)
- [116 Look What They're Doing with Magnets](#)

HOME AND YARD

- [23 Homeowners' Clinic](#)
- [69 Decorate Your Home and Yard with Walt Disney's Christmas Mobile](#)
- [134 New for Your Home](#)
- [137 2 Rooms from 1](#)
(Flagged for filing)
- [149 Pyramid "Tree" Brightens Your Lawn](#)
- [153 Nailing Tips to Lengthen Life of Your New Redwood Siding](#)
- [158 Solving Home Problems](#)
- [161 Automatic Thermostat Booster](#)

REGULAR FEATURES

- [6 Letters](#)

SHOP AND CRAFTS

- [143 Take-Apart Pull Toys](#)
- [150 Build a Tabletop Printing Press](#) (Part II)
- [162 Woodworking Tricks that Make You a Whiz](#) (Flagged for filing)
- [171 Helpful Reader Hints to Make Shop Work Easier](#)
- [172 Sander Table for Metal Lathe](#)
- [173 Deadman Switch Prevents Injury](#)

AEROSPACE, AVIATION, MILITARY

- [80 How to Get a Good Man Down](#)
(from Space)
- [84 Adm. Dan Gallery: So You Don't Remember Pearl Harbor?](#)
- [106 British Skybikers Take to the Air . . .](#)
(More or Less)
- [132 Poor Man's Back-Yard Whirlybird](#)

ELECTRONICS, RADIO AND TV

- [174 Phone Tattles on Burglars](#)
- [178 The Doctor's Black Bag is Full of Electronics](#)
- [180 New in Electronics](#)

BOATING, OUTDOOR RECREATION

- [126 Ski Parallel in One Day](#)
- [154 Build This White-Water Riverboat](#)
(Flagged for filing)

PHOTOGRAPHY

- [146 How to Take Better Christmas Photos](#)
- [170 New for Camera Buffs](#)

NEXT MONTH IN POPULAR MECHANICS

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LETTERS

TO THE EDITOR

Thatched A-frame

In your April issue, you have country houses (*Holiday House Built for Fun*, page 90, and *Vacation Homes*, page 129)



that are similar to the ones we have on the north of our island. The difference is that ours are covered with straw.

This type of house is very primitive and must be over 100 years old—and is still used because it is cool on warm days and quite warm in winter.

Funchal, Madeira Is. **JAIME ELOY LUIZ**

You are a bit ahead of the current boom in A-frame vacation houses in this country. How about thatched split-levels?

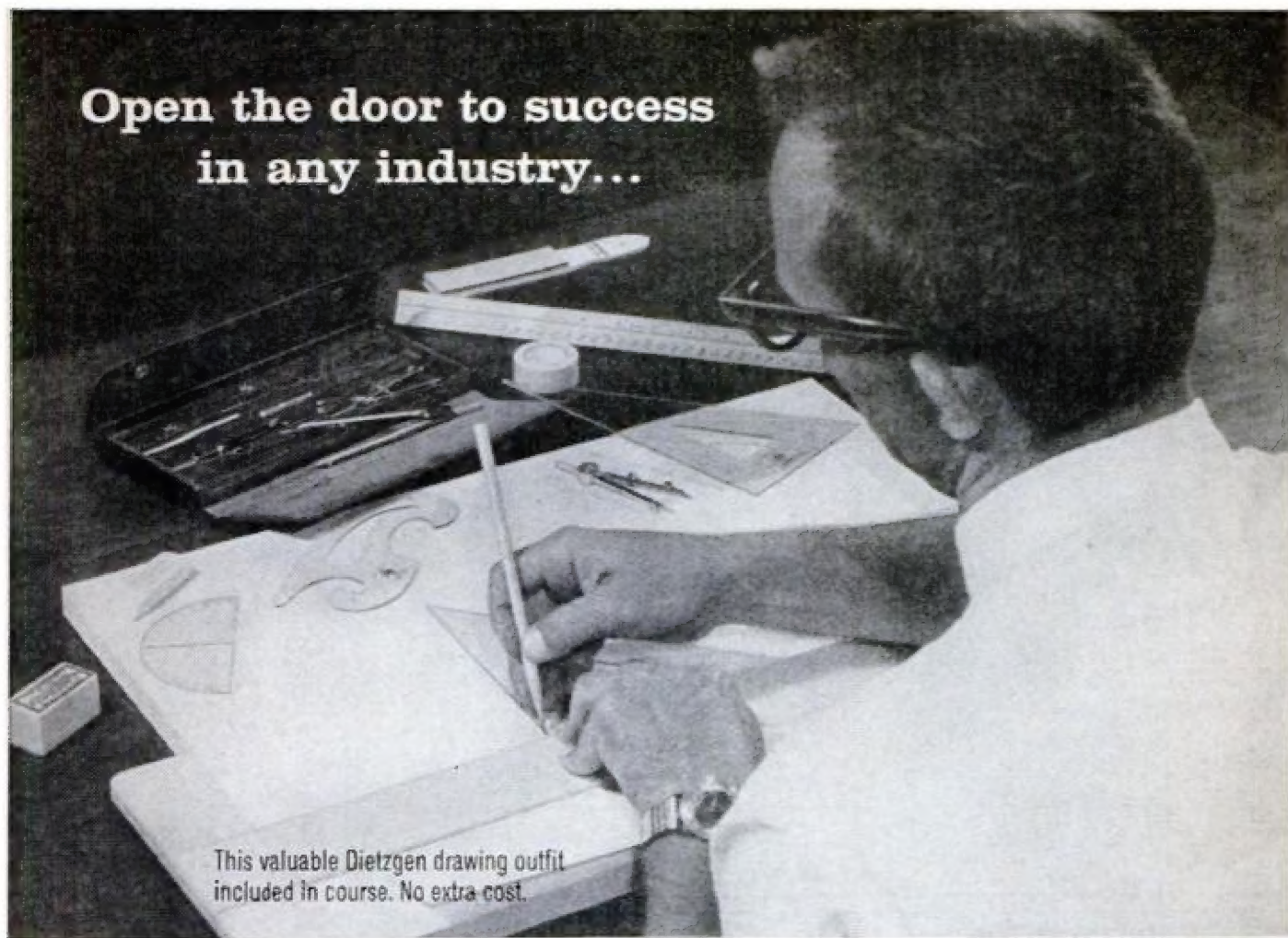
Outboard correction

On page 99 (October '66 PM) reference is made to the Homelite engine. The last sentence . . . reads: "It's shown here on the Boston Whaler, made by Fisher-Pierce, new owner of Homelite firm." Homelite outboard engines are manufactured for and sold by The Fisher-Pierce Co., Inc., under an agreement with Textron, Inc. The agreement in no way affects the Homelite Division of Textron as far as any Homelite products are concerned other than the four-cycle, 55-hp marine outboard engine.

Boston **EDWARD H. CULVER**, President
Culver Advertising, Inc.

Mr. Culver is correct. The Fisher-Pierce Co., Inc. is manufacturer and distributor
(Please turn to page 10)

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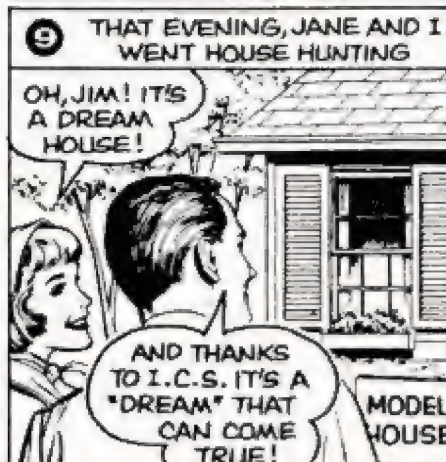
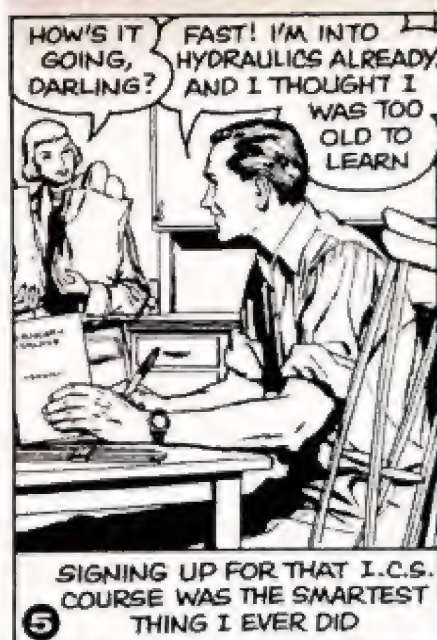


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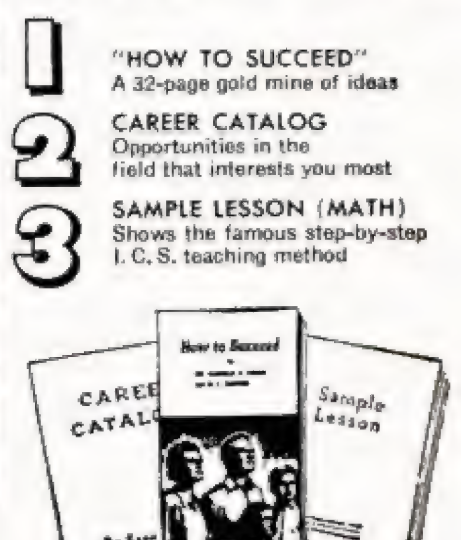
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NICHOLSON

LETTERS

(Continued from page 6)

of Homelite outboard engines; it does not own Homelite. And the engine goes on any boat—not just the Boston whaler.

Indian steel guitar

I have just finished building my Singing Steel Guitar (page 129, Aug. '65 PM). Of course, it cost me lots more than



your estimates because electrical equipment is not so easily available here.

The guitar plays beautifully, and I had very few difficulties making it.
New Delhi, India. NIRANJAN RATHOUR

Please don't eat the lichens

In your September *Science Worldwide* (page 14), a British scientist is quoted as saying that polonium-210 is high in Canadians because they live off reindeer and caribou, which graze on lichen that absorbs radioactive fallout.

I doubt that one Canadian in 10,000 has ever eaten reindeer meat.

A Britisher (not a scientist) might be excused for his ignorance, but surely the editor of the column, living next door to us, should be better advised as to our diet.
Kamloops, B.C. P. J. KEENAN

We've eaten very well in Canada any number of times—without resorting to reindeer, caribou, lichens or any other form of polonium-210. We like your diet.

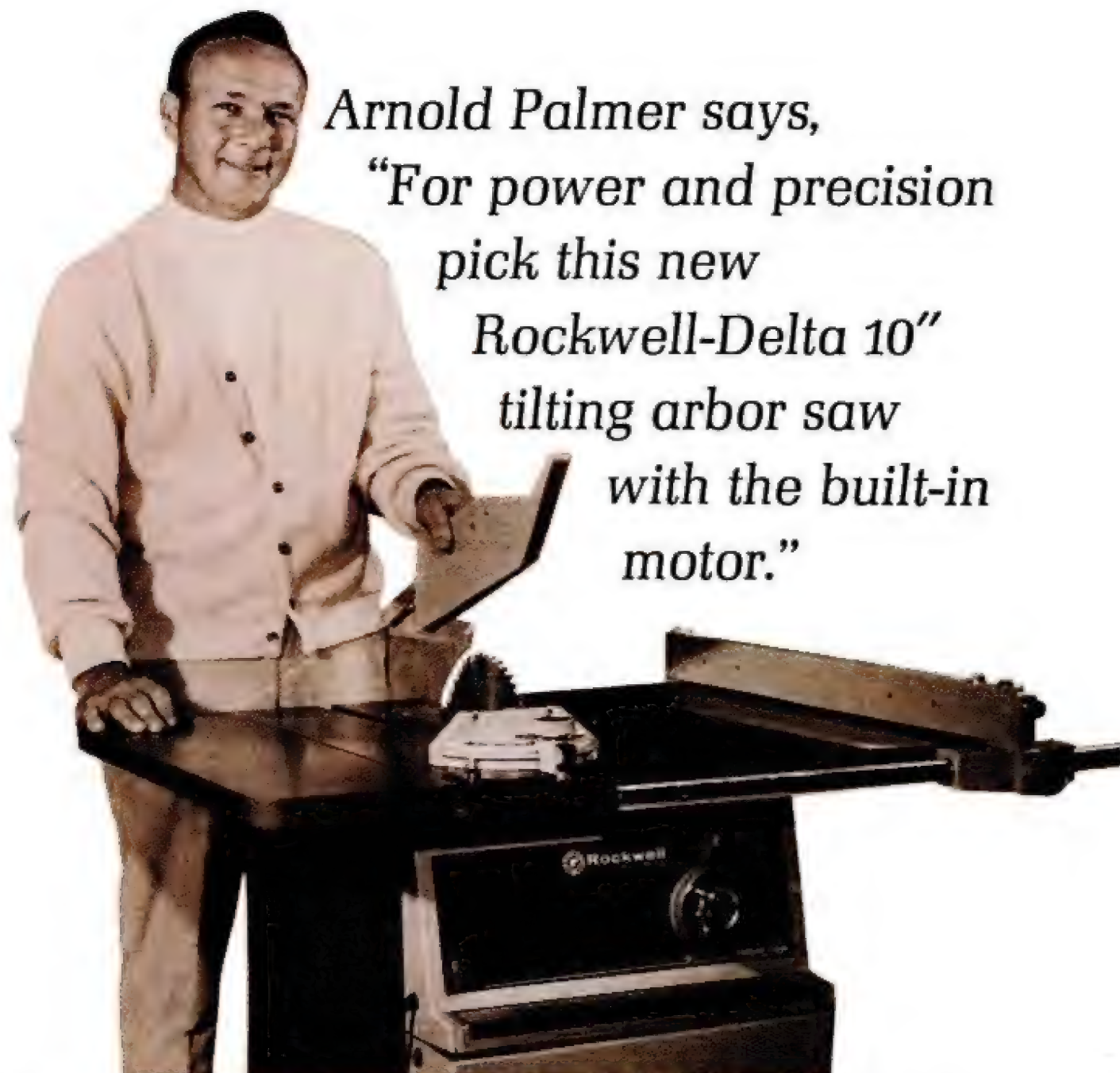
The British scientist had carefully qualified his statement, indicating that the study was made in a few northern areas of Canada. Unfortunately, that fact was left out of our report.

Nope, not putty

A reader's letter in your September *Homeowners' Clinic* (page 17) asks about nails pushing out wallpaper.

The answers are all correct until you suggest using putty in the nail holes. This is wrong. Putty has an oil base and will show through any and all paper after a few weeks. Perhaps if the putty was spotted or dabbed with a white shellac or flat paint it would help resolve the problem—unless a spackle can be used. But definitely not putty.

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D-6620

BY JOHN F. PEARSON
SCIENCE
WORLDWIDE

SOCKETS FOR TEETH made loose by disease can be created, according to two dental researchers at Boston University. Various diseases, they explain, can cause a loss of bone that forms the tooth socket. The problem—one that stubbornly defied solution up to now—was how to encourage new bone growth.

The Boston scientists' method, which is said to take about an hour under local anesthetic, involves cutting back gum and surrounding tissue, and boring small holes in the jawbone near the point where supporting bone has been lost. Probes through the holes force a soft type of bone material down to the void between the tooth's roots. The spongy tissue is filled with "embryonic bone cells" and stimulates the growth of new hard bone.

The scientists have used the technique on 100 patients and report good results.

MIRACLE FABRIC: paper. That's what dresses now appearing in stores are made of. They're cheap (some cost as little as \$1.25) and disposable. Made of a combination of about 90 percent paper and 10 percent nylon, they're said to be fire resistant. Reportedly in the works: sweaters for boys and underwear and swimming trunks for men. Yes, swimming trunks!

FLOATING WAREHOUSES—each to be almost as big as the 52,000-ton liner *United States*—are on the Navy's planning boards. Delivery date for the first of the Fast Deployment Logistic ships (FDLs) is slated for 1970. In all, from 15 to 40 will be built.

Operating at cruising speeds between 25 and 30 knots, the 800-foot-long freighters would be used to supply our armed forces in brush fire wars.

SUPER-SPEED COMPUTER that can handle 3 million instructions per second is at work for the Air Force. Mathematicians say the machine can do more arithmetic in one day than all the adding, dividing and multiplying accomplished in human history up to the advent of computing devices.

BABOONS can replace people as heavy laborers, says an anatomist at South Africa's Capetown University. Simple brain surgery, he explains, turns the nasty-

tempered primates into creatures that are "highly adaptable, willing to learn and second only to humans when it comes to living under trying conditions." The scientist says he knows of one baboon who worked as a porter at an African railway station and another trained to drive a tractor.

"WHITE WAX DISEASE," a paralysis, has hit 1500 lumber-camp workers in Japan. Numbness and whiteness of fingers and varying degrees of body paralysis are main symptoms.

Doctors connect the disease with the daily use of heavy chain saws, theorizing that the continuous vibration causes contraction of capillary vessels in the hands and an interruption of normal blood circulation. Similar cases have popped out among shipyard workers who use riveting machines and coal miners habitually using big power drills.

STEEL AS PLIABLE AS COPPER is now being produced by a major steel maker. The stuff can be used to replace copper—or even lead—for applications ranging from gaskets and blasting caps to soft wire and tubular welding electrodes. It costs less than copper, too—less than 9 cents a pound compared to more than 40 cents for copper.

NEW ESCAPE SYSTEM is being considered for use on the 400-foot service tower at the Kennedy Space Flight Center in Florida. The tower will service the manned Saturn vehicle when it's blasted to the moon.

Developed by an engineer working for a NASA contractor, the system is based on a series of cabins hanging from cables at different levels in front of the tower. In case of a mishap, technicians and astronauts still outside the flight capsule would jump aboard the cabins and drop into an underground shelter, where flaming liquids could not reach them.

MUSHROOMS grown on meat wastes produce a high-protein food, reports a research scientist at a big meat-packing firm. It's a fast way to create a basic food, he says, and could be an answer to the world's growing food shortage. Mushrooms can double their mass within hours.

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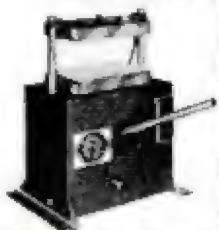
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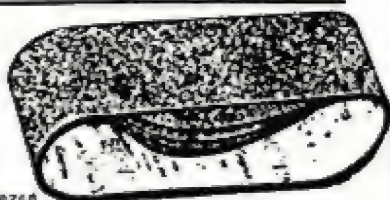
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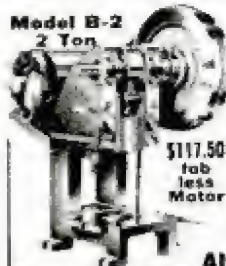


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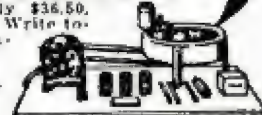
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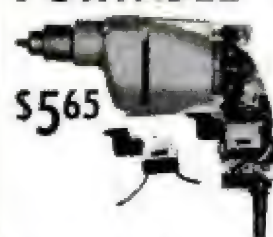
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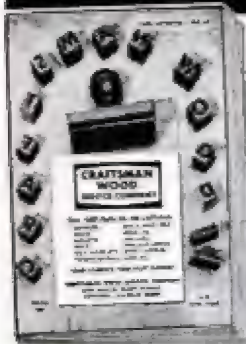
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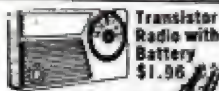
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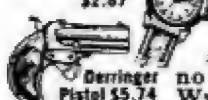
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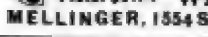
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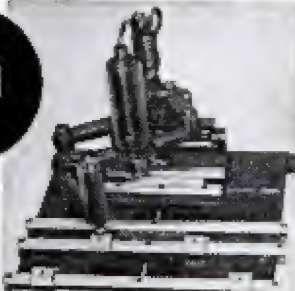
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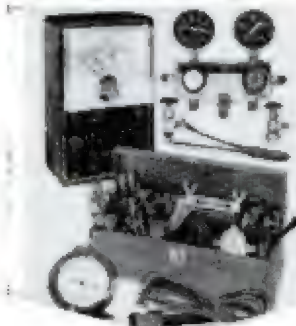
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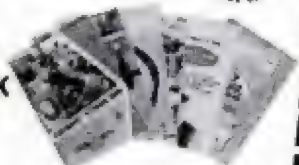
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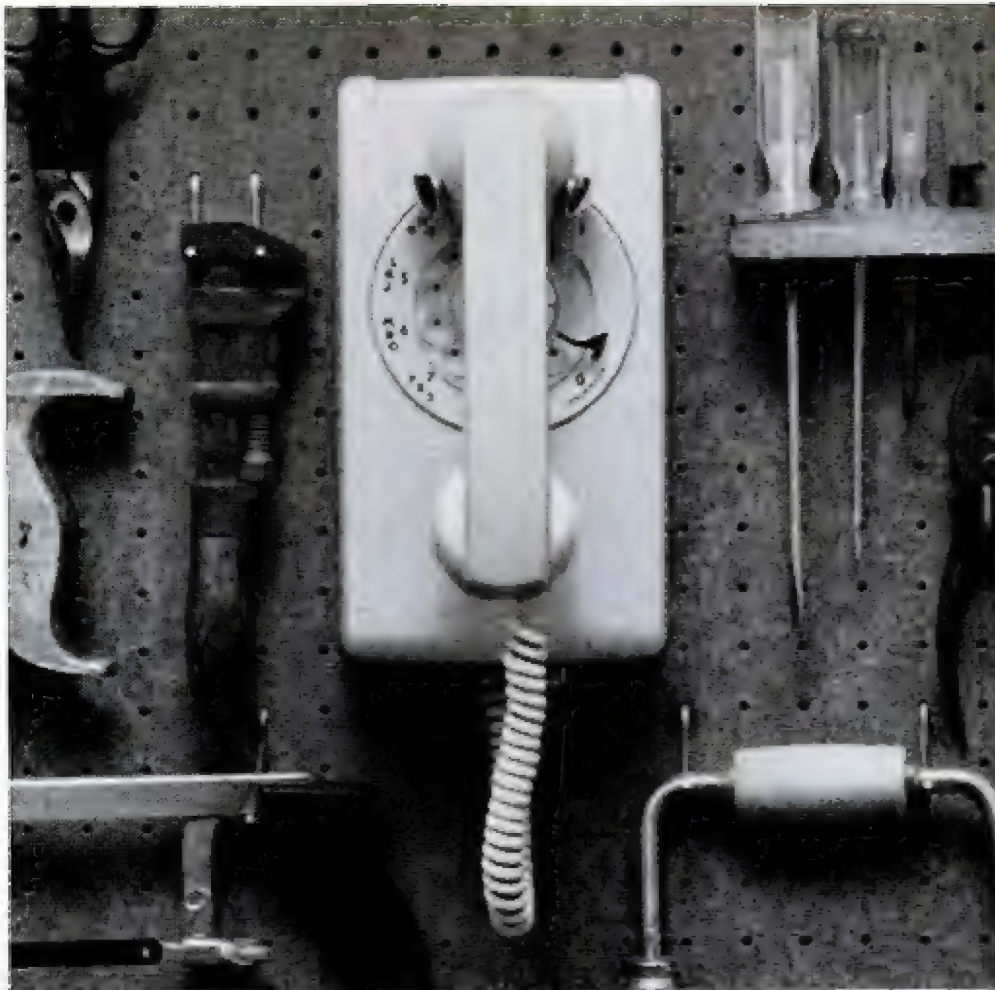
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Do point

The top of my chimney needs repointing. It's rough-textured face brick, and several of these require replacing as the surface, or face, appears to have broken away, leaving the center of the bricks crumbling and the face loose. I'd like to do the job myself. Can you advise how?
—N.W., Ind.

I admire your determination to tackle the job yourself, but I can't tell you all the how-to in such limited space. So I'll give you a few general suggestions and you can take it from there. Get a ready-made mortar mix from your building materials dealer and a pointing trowel from the hardware dealer. Remove the defective bricks—not more than one or two at a time—and chip and brush away all the old mortar. Then mix the new mortar fairly stiff so that it is more easily handled, dampen the area the new mortar will contact, select new bricks of a texture to match the old, mortar the back, both ends and bottom of the new brick and press firmly into place. Then press new mortar into the space between the top of the new brick and the bottom of the old, making sure this space is filled and the mortar pressed tightly in place before the initial set. Strike (trowel) the new joints to match the old and brush away all new mortar, both the excess from the joint and any that may drop onto the bricks at any point. It's difficult to remove after it sets. In repointing where the old bricks are still intact and in place, chip away old mortar to a depth of at least 1 in. and repoint with new mortar. Then strike the new joints to match the old.

Water marks

I have a new birch front door which I shellacked with a first coat. Before I got it coated with varnish there came a shower of rain; now the lower half of the door shows light-colored streaks which did not disappear under a coat of varnish I applied later. It's most unsightly. What can I do now?—H.W., Neb.

I'm afraid that, come spring and warm weather, you'll have to redo the job of finishing. If you used an outdoor varnish the door will go through the rest of the
(Please turn to page 24)

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HOMEOWNERS' CLINIC

(Continued from page 23)

winter without any marked change. When there's warm, drying weather again, take off the old finish down to the bare wood with a wash-off type remover. Do a thorough job of sanding to prepare the wood for a new finish. Sand off sufficient wood to remove any lingering traces of the streaks. Then omit the shellac and apply a sealer especially prepared for the purpose. When thoroughly dry, smooth this coat with fine steel wool, dust to remove any loose material and then apply one or two top coats of a clear outdoor finish on all four edges.

Sneak attack

Recently I opened a small box of what had been old books and magazines in storage in my home. Several had been partially reduced to a kind of flaky powder. There were no apparent holes in the pages or the cardboard box. The box was stored in a dry closet. Can you tell me what was the cause?—H.A., Tex.

Your description of what is left makes it sound like the work of insects known as silverfish. Even though you may be alerted to their presence you rarely see one. Only when you lift or move some ob-

ject that has been in place for some time in an out-of-the-way corner are you likely to see one or more of them racing for cover. They are of a size and build that could easily gain entrance to a conventional cardboard box. There are also what are commonly known as "book lice," but according to your description the silverfish are the most likely invaders. Getting rid of them in a household isn't so easy, but judicious use of an insecticide containing rotenone powder is fairly effective. Simple removal or frequent moving of all likely hiding places often will rout a minor infestation.

Pump in sump

I need a sump pump to remove seepage from my basement. My plumber says the sump should have an "open bottom" to permit water to enter at the low level. Is he right?—H.D., Minn.

Your plumber will know local conditions better than I, and for this reason alone I would say he is correct in his recommendation. The open-bottom sump he has suggested will admit water to the pump from a level beneath the floor. The condition, apparently now present, will either be eliminated entirely or so greatly reduced that seepage will no longer be a problem.

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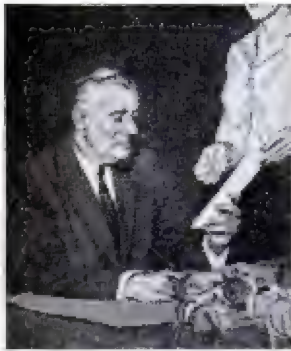
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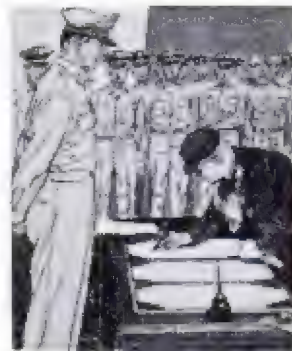
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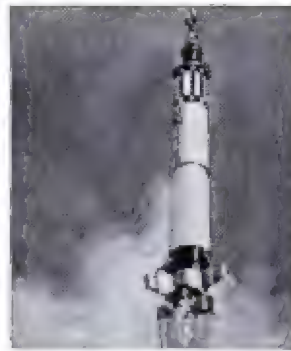
1953: Dr. Salk develops polio vaccine.



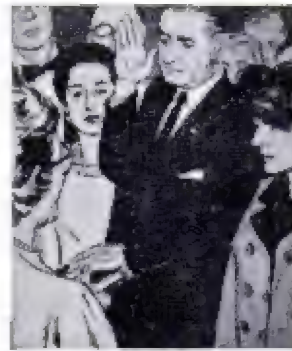
1956: Don Larsen hurls first perfect Series game.



1959: St. Lawrence Seaway opens. \$17 billion in E Bonds over 10 years old.



1961: Alan Shepard is first U. S. Astronaut in space.



1963: John F. Kennedy assassinated; Lyndon Johnson sworn in.



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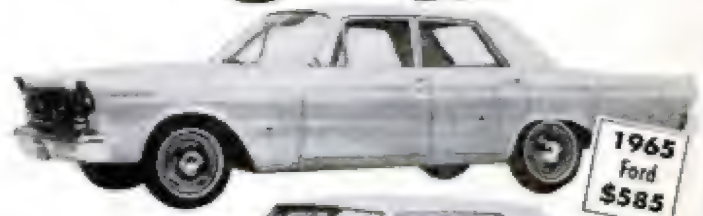
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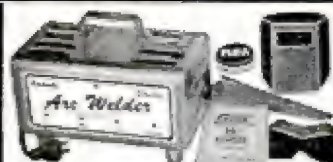
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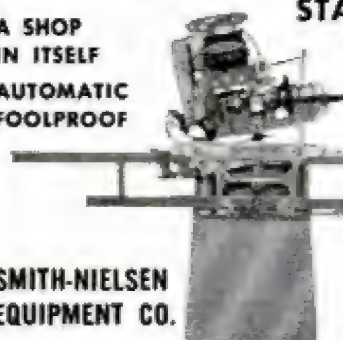


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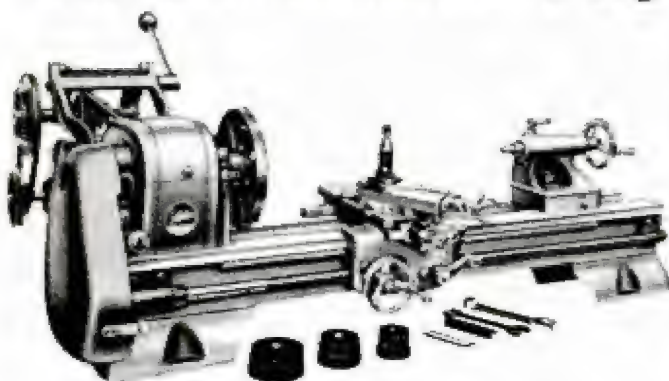
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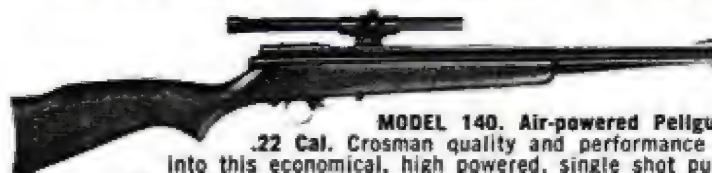


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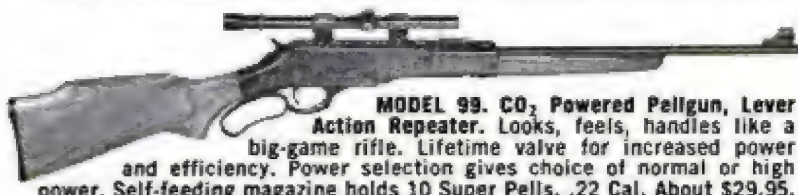
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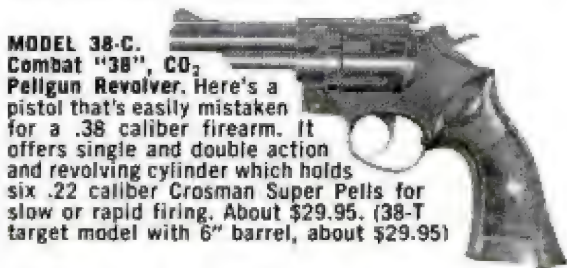
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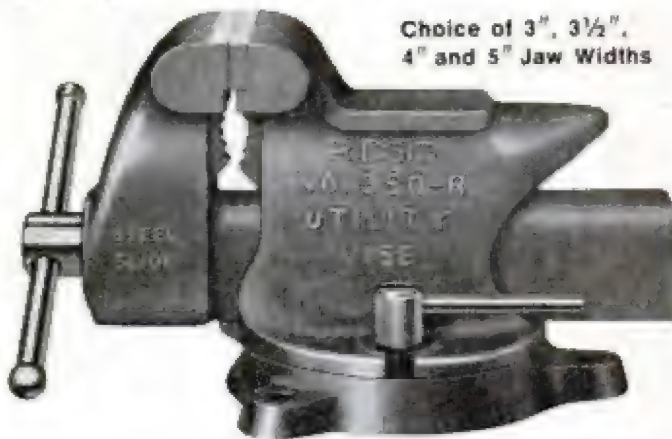
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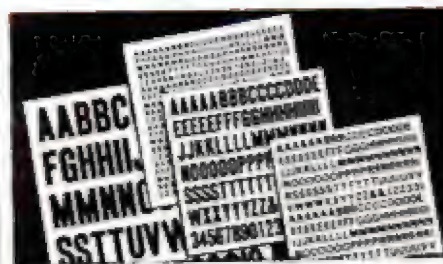
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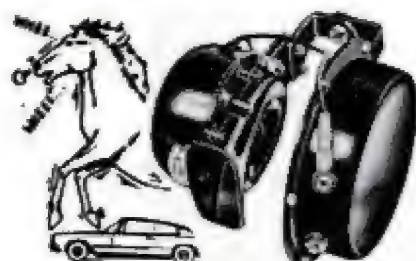
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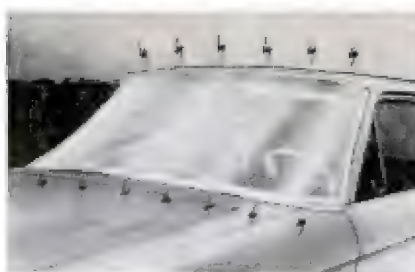
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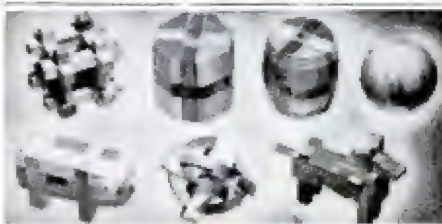
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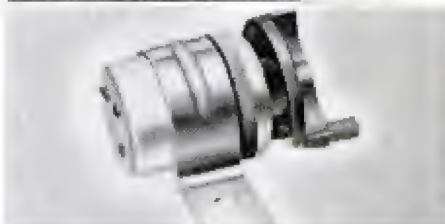
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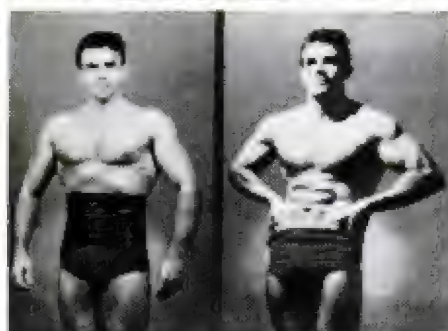
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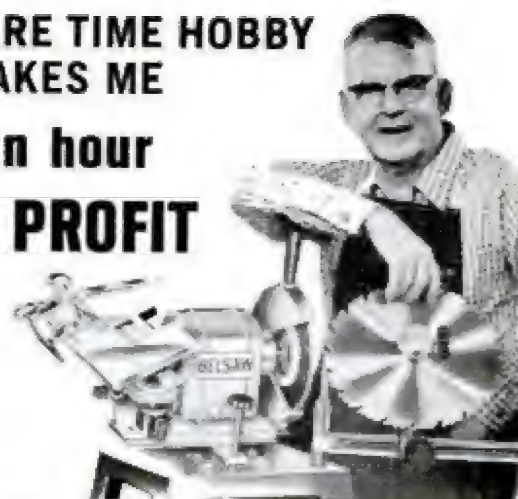
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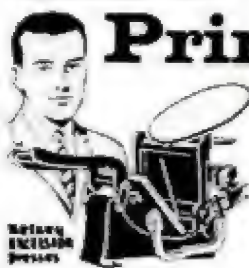
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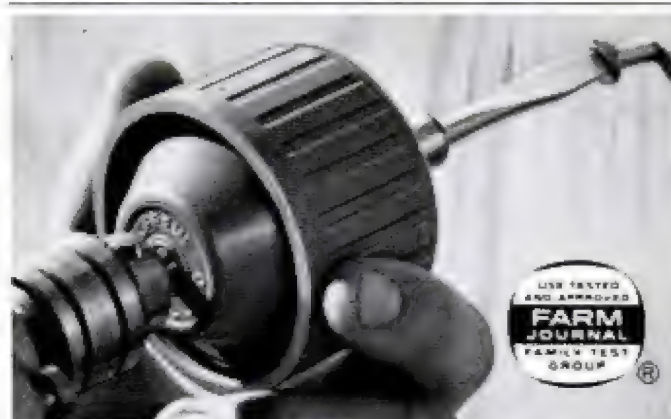
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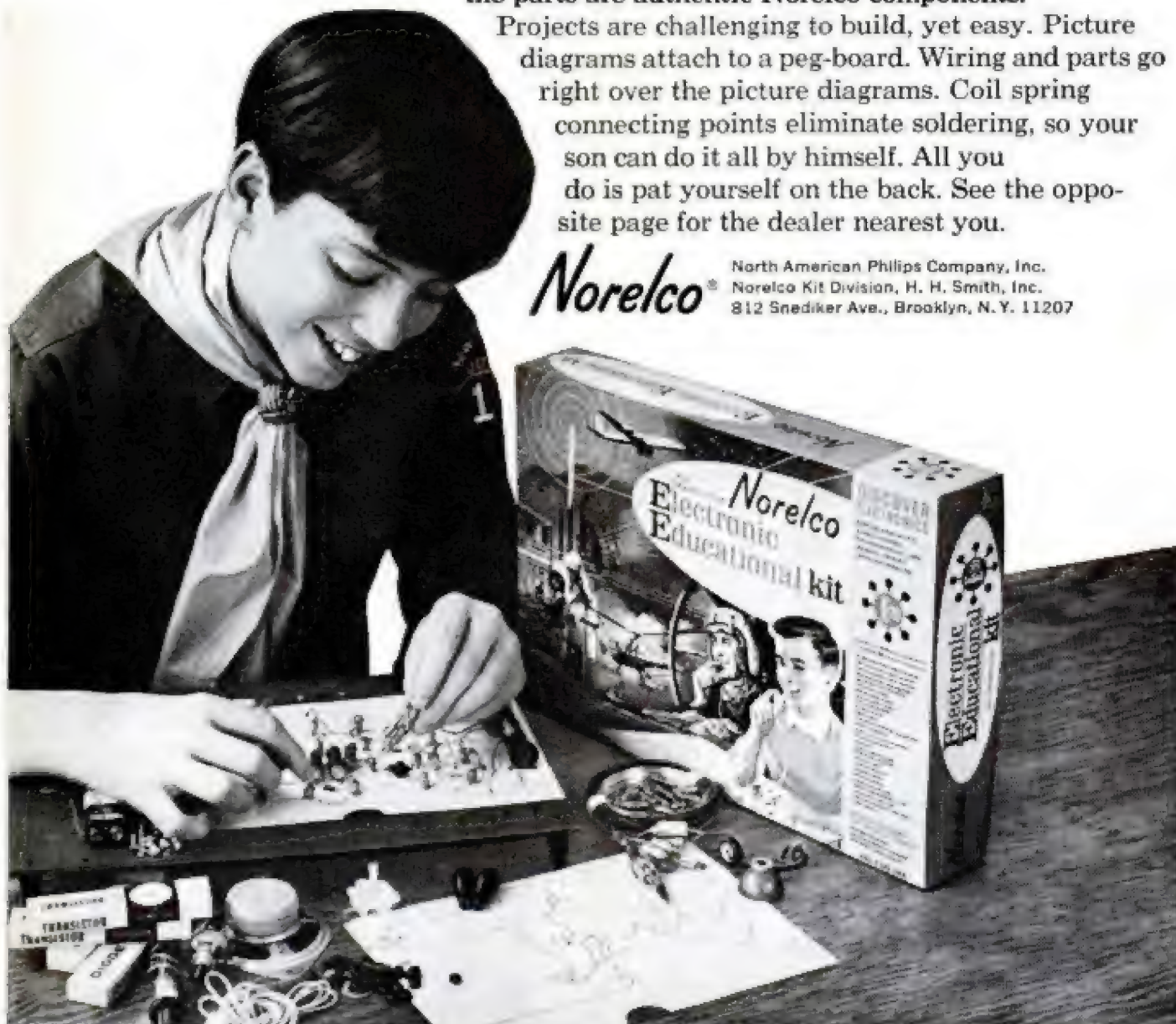
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LISTENING POST

BY BOB IRVIN

ELECTRIC CARS ARE BACK IN THE NEWS. Study projects are under way at GM, Chrysler and Ford, the latter apparently all-out to be the first modern auto firm to market an electrically-powered vehicle. Ford is building working prototypes of a sub-compact, six-foot-long car designed for city driving. The car will be big enough to carry two adults plus two children. The first models, due for testing next year both here and in England, will use conventional lead/acid batteries and have a cruising range of about 40 miles. Top speed will be about 40 mph. Ford hopes later models will have a 150-mile range, thanks to a newly-developed sodium/sulphur battery the company says represents a "major breakthrough" in efforts to evolve an electric vehicle. This type of battery can store as much as 15 times more power than a lead/acid battery and can be recharged endlessly. The new battery will also make possible higher speeds. While both GM and Chrysler have yet to make a public announcement regarding their electric car projects, Ford has told the world it hopes to have such a vehicle on the road within two years.

Interesting sidelight: The world's first race to establish a land speed record—back before the turn of the century—was between electric cars; one built by a Frenchman, the other by a Belgian.

DISC BRAKES ARE FINALLY WINNING FAVOR with U.S. automakers. Standard this year on the front wheels of big Chrysler and Dodge station wagons, they are an option on most '67s. Top men from both Bendix and American Brakeblok have said they expect all U.S. cars will have standard front discs by the 1969 model year. "This will run into many millions of dollars," says one supplier. (He means that's what motorists will wind up paying.)

FRONT-WHEEL DRIVE IS "IN" AT OLDSMOBILE. The GM division is already at work on a four-door version of its fwd Toronado, has plans to install the unique drive train in other cars in its line. Olds' chief engineer John B. Beltz says high cost is what keeps fwd from being standard on all cars now. He believes the cost can be trimmed in a few years to a point where it can be used in cars selling for under \$3000.

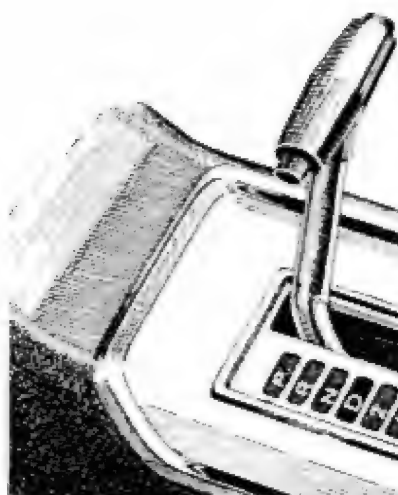
THE FIVE-YEAR, 50,000-MILE WARRANTY may be the practical limit to such new-car guarantees, says Chrysler veep Harry Chesebrough, commenting on the latest round of automaker one-upmanship over warranties. His firm has had a "5-50" warranty on the power train for the past four years. GM matched it this fall. So did Ford and American Motors. On the rest of the car, GM, Ford and AMC had a 24-month, 24,000-mile warranty, Chrysler a 12-month, 12,000-mile warranty. Chrysler matched the "24-24" arrangement, then raised the ante by including steering, suspension and wheels under the "5-50" warranty. The other boys met the bet—Ford, GM and AMC (in that order) following Chrysler on the improved "5-50." What's next? Chesebrough thinks that in future years more items will be added to and included under the "5-50" coverage.

TURBINE ENGINES MAY REPLACE DIESELS IN TRUCKS, probably within 5 to 10 years. That's how Ford and Chevy see it, anyhow; both are well along on truck turbine programs. GM's Detroit Diesel Div. is working up production cost estimates on a turbine engine now powering an experimental Chevy truck. Usually this means somebody is real serious about the idea.

Newest turbine in town is the one announced this fall by Ford. It boasts about 300 hp, half the size of the brute used in Ford's "Big Red One," a huge experimental truck unveiled a few years back. The brute engine was basically one developed by Ford for the Navy. But it was deemed too big for commercial use. The new engine, however, is

(Please turn to page 45)

*Ford's New Wave
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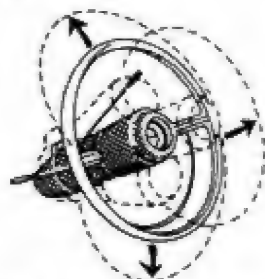


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Unexpected ideas like a 390-cubic-inch V-8 with a dual personality—it's got the powerful acceleration and hill-climbing thrust you want in a big engine, yet sips low-cost regular gas through a thrifty, two-barrel carburetor. Other great Ford engines — from a 240-cubic-inch Six to a fiery 427-cubic-inch V-8.

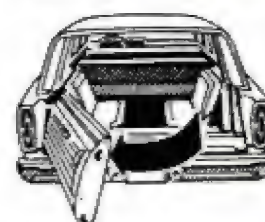


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on Fords and Thunderbirds, it also locks doors automatically at 8 mph.



Exclusive ideas like Magic Doorgate, standard on all Ford and Fairlane wagons, that swings open like a door for people . . . swings down like a tailgate for cargo. Optional on Falcon wagons.

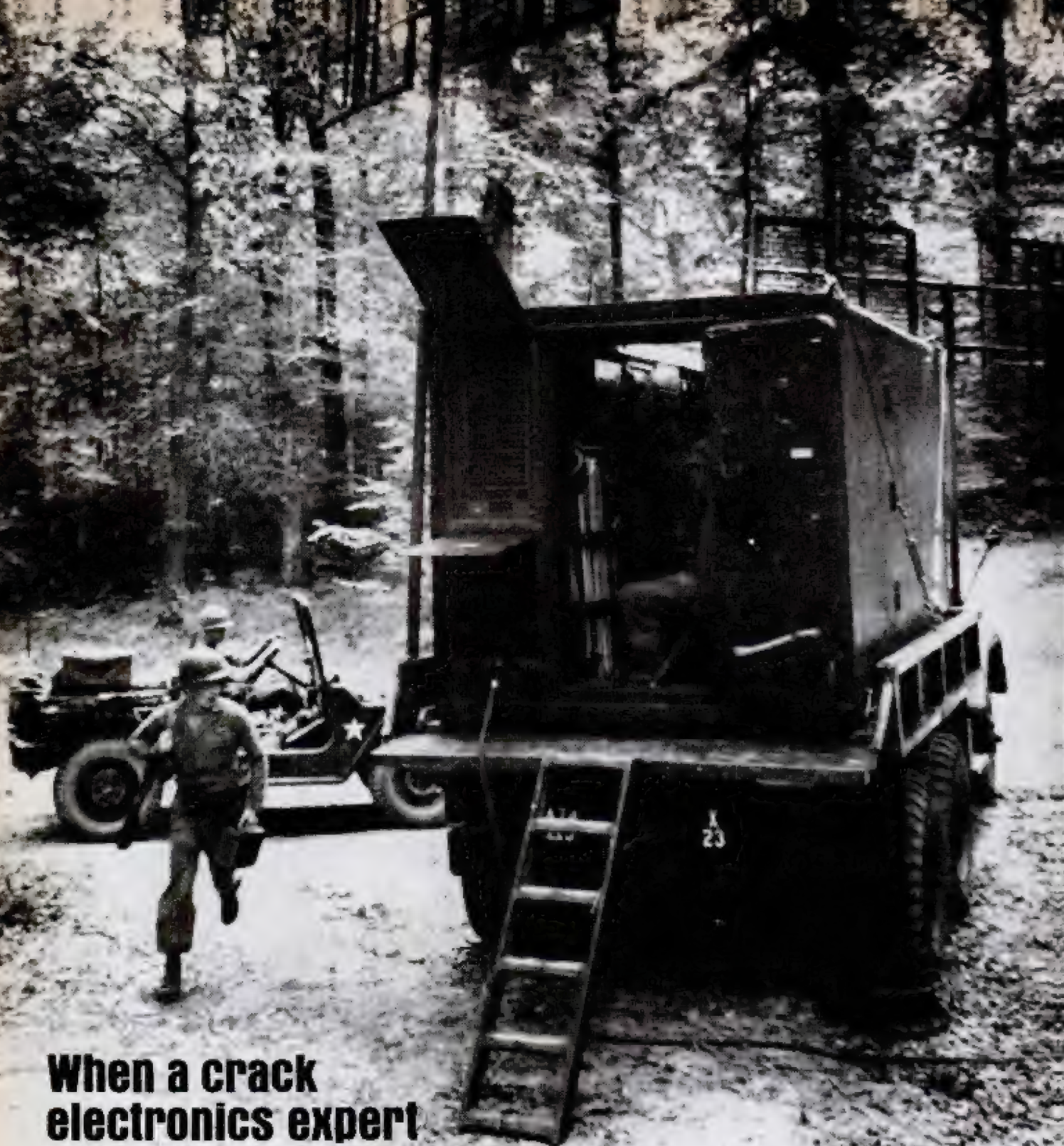
Important ideas like Ford Motor Company's standard Life-guard-Design Safety Features . . . or like the solid, substantial '67 Ford . . . one of the quietest riding cars in history—quieter because it's stronger, stronger because it's better built.

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Army

DETROIT LISTENING POST

(Continued from page 42)

supposed to be ideal as to size/power/weight. In fact, the engine was designed to fit the compartment of Ford's new W-series of highway tractors. "We believe turbines have a very real place in future vehicle transportation," says Ford engineering veep Dr. Michael Ference, Jr. "We see the turbine replacing the diesel in about 10 years in heavy trucks."

Chrysler, meanwhile, continues work on its passenger-car turbine. Results of tests on the new "fifth-generation" engine have been termed "good." Scuttlebutt has it that if Chrysler *does* produce the engine, it will be for the Dodge Charger.

REPORT FROM SWEDEN. Even revolving doors go the wrong way in Stockholm—not to mention automobiles. Unlike in Britain, where cars also keep to the left but have right-hand drives, Swedish cars have the controls on the left as we do in America. Pulling out to pass a truck on one of Sweden's winding two-lane highways can be hairy. What you've heard about Swedish drivers is true. There are indeed no speed limits, except at certain spots in cities. What's more, the Swedes don't go for stop lights. In Gothenburg, a city the size of Minneapolis, we saw only one intersection with signals.

Volvo's new assembly plant just outside Gothenburg, is one of the most modern in the world. There's a lot of emphasis on inspection. We saw one Ingrid Bergman-type trying to drive a chisel between the joints to see if the welds would hold—and she was doing this on every car.

We drove a Volvo from Gothenburg to Stockholm—an all-day journey through farm and lake country—which explains why Swedes like Minnesota. Driving is easy if you remember to stay to the left of traffic islands. (One of our companions didn't, much to the confusion of local motorists.) Roads are well marked in international "sign-language." Gas stations carry such familiar emblems as Gulf and Esso. Sweden plans to switch over to keep-to-the-right driving next September—all in one glorious day. Remind us to stay in New York.—*Bob Crossley*

SEVERAL NEW CAMAROS were bought by Ford and sent to Ford's proving ground near Romeo, Mich., where engineers are

(Please turn to page 48)



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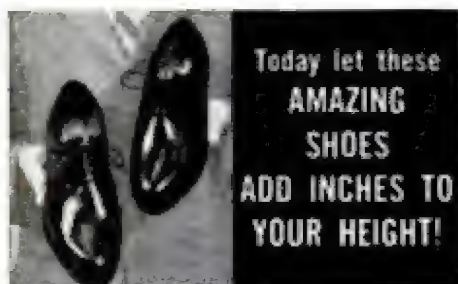
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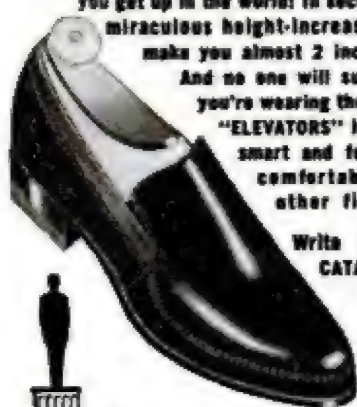
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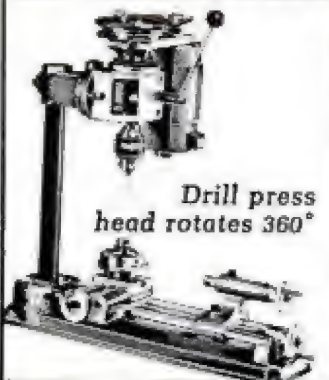
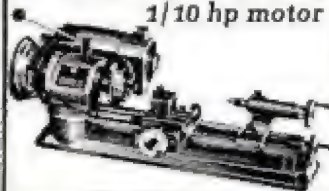


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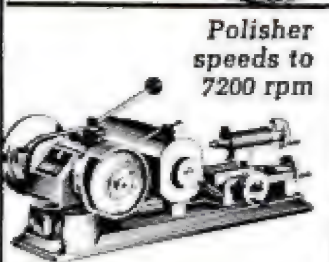
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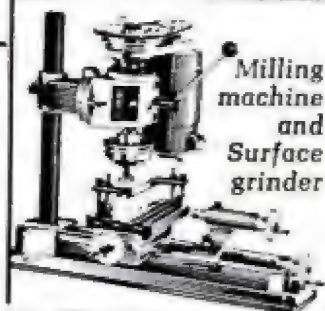
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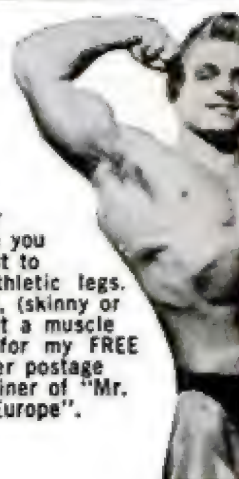
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DETROIT LISTENING POST

(Continued from page 45)

paying more than usual attention to the Mustang's newest, most threatening competitor. This is pretty much SOP in the industry, however, and raises no eyebrows. One Camaro is being put through a 50,000-mile durability test to see how it stacks up against Mustang, the others checked for various similarities and differences.

There used to be an informal exchange agreement between some companies on test vehicles, but not any more. Ford bought its Camaro, from franchised Chevy dealers. "They like the business," one Ford man said. For one thing, there's no haggling over price; Ford pays the man what it says right there on the sticker.

THE 1968 AMX PRODUCTION CAR at American Motors will not have a plastic body—at least not right off the bat. AMC chairman Bob Evans says the car will be produced in '68, but will feature a conventional steel body. However, AMC is working on a small sub-compact it hopes to have ready by 1969-70, and this may have a plastic body. If the body-making technique is successful all 'round, it may be employed in making plastic bodies for the AMX.

INCA IS THE NAME and car design is the game. INCA stands for Integrated Numerical Computer Analysis, GM's term for its computer-based system to help design and construct cars. Most extensive use so far has been in the development of Chevy's new Camaro.

"INCA eliminated several steps in the normal process of transferring a clay model into the production model Camaro," reports Chevy headman E. M. "Pete" Estes. The design of the clay model was put on tape and fed into a computer. Result: perfect die models for the car, making the usual wood model intermediate steps unnecessary. The computer was also used in developing the chassis and suspension arrangement of the Camaro. Desired steering and handling characteristics were programmed into a computer that then developed the suspension system, doing the complete set, even to location points for the springs.

The idea isn't new. Ford has used computers in much the same way. In fact, a Japanese automaker claims to have developed a technique using a laser beam to measure a clay model and produce from it a production die, thus eliminating all intermediate steps. INCA isn't this far along yet, but, according to Estes, eventually will be.

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Plan to have a ball in the snow, this winter. And just for the fun of it, be sure to invite a Bolens Diablo Rouge snow vehicle. There's nothing quite like a racy, rollicking ride on a Diablo Rouge to add healthy color to the cheeks of your family and friends. And to give them an entirely new appreciation of the appeal and excitement of snow-gliding—Diablo-style! First with front-end traction, Bolens Diablo Rouge

continues to lead the way with features such as: quick, easy handling; the ability to turn in its own length; 16 h.p. Hirth engine; dual headlights; roomy suspension seat (for three) with extra storage space; 28 rubber bogie-wheels and spring-mounted idler sprockets; extruded aluminum cleats on Nylon rubber-covered belting. Go on, be a sport—go-go Diablo . . . you'll have a lot of snow fun.

24-66R1



BOLENS

BOLENS DIVISION, FMC CORPORATION, DEPT. DM-74-24, PORT WASHINGTON, WISCONSIN



IN '67 BUICK

Get in with the In Crowd in a Skylark

Now that the new cars are out, there's not much doubt which one's In. And that's Buick. You want proof? Get your hands on a Skylark. A sweeter-handling machine, a more comfortable chariot you'll never find. And it has a new braking system with dual master cylinders, and every one of the new GM safety features. But to get your hands on the car, you have to get your hands on the keys. At your Quality Buick dealer's. (Four out of five new-car buyers pay Buick-sized prices. Shouldn't you have the Buick?)



SOLUTIONS FOR MECHANICAL HEADACHES

AUTOMOBILE CLINIC

BY MORT SCHULTZ

Soapy detective

Here's an innovation that came to me quite by accident. It concerns that rough problem of how to trace a minor leak through a windshield.

I had been looking for this leak for a long time. A good two tablespoonfuls of water would enter the car every time it rained, despite all the sealant and rubber cement I'd applied.

Then, while washing the car, the solution happened upon me. I turned the heater on full blast. As I sloshed the windshield with the soapy solution, a large soap bubble appeared at the site of the leak—at the top of the windshield when I had been looking for it at the bottom. After letting the spot dry, I dabbed on rubber cement, and the leak hasn't recurred since. How do you like them apples?—Ken Brown, Elgin, Ill.

Beautiful, Ken. Simply beautiful!

Drop the pane, Eddie

The owner's manual for my 1964 Galaxie 500 convertible implies that I can lower the top with the glass rear window in place. The dealer says that I should first lower the window to avoid breaking it. Who's right?—Ed Cook, Flora, Ind.

I go along with the dealer, Ed. An ounce of prevention . . . you know. There's always the chance that the window will cockeye itself while being lowered with the top, which could cause it to break.

Front, not rear, is bugged

My '65 V8 283 straight-stick Chevy has been missing and bucking at speeds below 30 mph from the day I got it. The dealer, after doing some tests, now says it's "normal"—that it's caused by the rear end. The missing starts when you slow down to about 30 mph on a pull or when driving slow in either high or second gear. I insist it's the engine. What do you say?—Oscar Paulson, Lewistown, Mont.

I agree with you. If a good tune-up doesn't correct it, take a compression test. If that's okay, I'd start suspecting a bad camshaft. Naturally, the cost of replacement of any parts should be ab-

sorbed by the dealer, not you, since you bought the car with the bug in it.

Up the creak

I've isolated an annoying creak at the left-front suspension of my 1965 Pontiac. The creak appears most often when I turn the steering wheel back and forth with the car standing still and the engine running. I know noise problems are tough for you to trace without seeing the car, but I was hoping you had something in your files about this.—Jerry Wilde, Birmingham, Ala.

You're lucky, I do. Some early-model '65 Pontiacs were known to creak from this area because of a lap joint directly behind the spring pocket on the bottom of the left-front frame rail just forward of the rivet. You can have a creakless car by using a chisel to separate the two pieces of lapped metal between the rivet and the spring-pocket opening.

A matter of plain torque

I had to have the rocker-arm cover gasket replaced in my 1964 Studebaker. Now, I've got an oil leak. Why?—Carl Barna, Trenton, N. J.

Your mechanic probably confused the type of gasket and its torquing specification. There are now two types of rocker-arm-cover gaskets made for Studebakers. One is plain cork, the other's neoprene-covered. Over- or under-torquing either one leads to oil leaks, and each has its own torquing spec. The plain cork gasket should be torqued to 55-75 in.-lb. The neoprene-covered gasket should be torqued to 40-55 in.-lb.

Full of air

I'm having one heck of a time getting a full brake pedal on my MG following a brake job. Several mechanics have tried, but with no success. Is it my particular car or is it inherent in all MGs?—Carl Quincy, Houston.

I have to thank a friend of mine who's a crackerjack foreign-car mechanic for

(Please turn to page 66)

How to get the REMINGTON 500 for Christmas.

*Here's what I want
for Christmas.*

*The Remington 500.
It's the best shaving
instrument ever.*

Cordless Top.

*Let's me dial a perfect
shave everytime.*

*I know it's my face,
but after all, you look
at it more than I do.*

Love,

1. Sign this note and cut out.

2. Cut out picture of the
cord/cordless REMINGTON®
500 Selektronic shaver.



3. Cut out envelope and assemble.

To the one I love most

4. Put note and picture of
shaver in envelope,
and give to her.

P.S. This is the way
it looks in the store.



Suppose you want to give a Winchester 22 to your 12-year-old. But the wife says, "It's too dangerous now. Wait till he's older." What do you tell her?

First, tell her exactly why you think a boy should learn to handle guns early. Tell her he may not get a chance later. And too many kids grow up thinking guns are toys.

Tell her a boy's hankering

to shoot and go hunting is perfectly normal. Something he's born with. A part of his American tradition.

[What's wrong with a boy wanting to be another Davy Crockett or Dan'l Boone?]

Tell her what it's like for a boy in the woods with a 22. Tracking his first rabbit. Outwitting a fox. Sitting very still under a squirrel tree.

What to tell your wife when



These are things a boy will remember all of his life. And if he misses them now, he'll never have a second chance.

Tell her that state conservation programs even encourage hunting to help maintain the balance of nature.

And the National Rifle Association conducts a shooting program to teach youngsters gun safety and sportsmanship

and how to handle guns.

Finally, tell her that when an oldtime hunter like you has a boy who wants to hunt, it's his obligation to teach him all he knows about guns, game and the ways of nature.

And buy him a Winchester.

And take him hunting.

Why a Winchester?

Because at Winchester we still believe 22's are real guns.

you buy her son a 22.



WINCHESTER

AUTOMOBILE CLINIC

(Continued from page 62)

this one. No, it's a problem with many MGs following a brake job. It's caused pure and simply by the system being ornery—it just doesn't want to release all of its air. After the brake job, then, pump up the brake pedal to its fullest height and put a block between the pedal and the car's seat so pressure is put on the pedal. Leave it there overnight. The next day, pump up the pedal again. You'll now find that all the air has been pushed from the system and your brake pedal is restored to proper height.

A mind of its own

My '58 Plymouth Belvedere has a strange condition. When running at a sustained speed of 40-45 mph on a level highway, it will suddenly accelerate slightly and then break off. The action is much more rapid than could be caused by the driver permitting his foot to vibrate on the gas pedal. From what I've told

you, do you think you could tell me what's wrong?—Howard Rossetter, La Feria, Tex.

One of four things, to wit: 1. Incorrect heat range of sparkplugs for the type of driving you're doing; 2. A plugged-up, in-line gas filter; 3. Where the engine is of the big B type, there's also a filter in the fuel pump that few people know about—it may do the trick to remove it and clean it; 4. Fuel pump—I'd check the pressure and vacuum, making sure that they are to specs given in your owner's manual. Your problem, no doubt, is one of these.

Note: The great reader response to Auto Clinic has resulted in a considerable backlog of letters. However, the recent introduction of a new, faster method for handling this mail will soon help speed back the answers to your inquiries. In the meantime, please be patient. Your letter is being researched and will be answered at the earliest possible date. Thanks.

Service Tips

- **When a screw is not a screw.** You 1966 Dodge Coronet owners who have the 426 Hemi engine and who do your own work ought to note that those "screws" in the front and rear of the intake manifold are not screws at all. They're dowels. When servicing in this area, it's essential that these not be overtightened. They should be run up finger-tight—specifically, don't tighten them more than 10 lbs.
- **Dodge is disturbed** about what it calls "shortcut" sealing methods being used when the rear window of its '66 Monaco and Polara models has to be replaced. It reports that to insure a permanent glass installation free of water leaks, adhesive sealer kit No. 2807425 must be applied as directed in TSB D66-54. It's a good point to consider if you have water coming in.
- **Oldsmobile reports** that many cases of a generator warning light coming on intermittently in its cars have been traced to a loose attaching screw for the Delcotron brush lead. It's recommended that if the light winks like a fickle female, the Delcotron end frame be removed and the attaching screw tightened.
- **Pontiac has issued** a cure for improper choke or throttle operation for its cars equipped with Carter AFB carburetors. The problem, it states, may be caused by the carburetor extension lever binding against the fast-idle connecting rod. The solution is to remove the lever and file or grind $\frac{1}{8}$ in. from the inside edge.

Each month Auto Clinic answers questions on car repair. For a personal reply, send 50 cents in coin to cover mailing and handling. Write Auto Clinic, Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. One question per letter, please.

Go 'Jeep' V-6

(for the fun of it!)

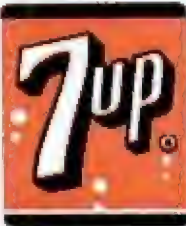


Pile in the family—and head for the snow country. The fun starts when you turn the key! That hot new V-6 gives you all the "zip" you'll ever need—160 horses strong. You cruise the highways as if you had wings—that's why we call this the Flying 'Jeep' Universal. And you feel safer, with that solid 'Jeep' build, plus the extra traction of 'Jeep' 4-wheel drive. Ice on the road? With all 4 wheels gripping for you,

you're less likely to skid. Snow? Don't stop...run right up the slopes! Choose the jaunty 'Jeep' Tuxedo Park Mark IV (shown), or familiar 'Universal.' Both with V-6 engine or world-famous 'Hurricane' 4...bucket seats...81" or 101" wheelbases...tops, colors galore...special equipment. You've got to drive it to believe it! See your 'Jeep' dealer. Check the Yellow Pages. **KAISER Jeep CORPORATION**
TOLEDO 1, OHIO

The Flying 'Jeep' Universal
with 4-wheel drive



The more  *the merrier*

A bright welcome is 7-Up. Crisp and Crackling—Bold, Bracing and Holiday Fresh! So cheers! 'Tis the season to be 7-Up jolly! **7-UP...THE MAN'S MIXER**



DECORATE YOUR YARD AND HOME WITH

Walt Disney's Christmas Mobile

Created expressly for PM readers by world famous Disney studios, this unusual outdoor Christmas decoration is sure to cop first prize in any neighborhood lighting contest.

By WAYNE C. LECKEY

YOU MIGHT KNOW, when Walt Disney has a hand in anything, it can only turn out to be fantastic.

When PM editors went into a story-planning huddle last July, wondering what new idea we could dream up for this December issue in the way of an outdoor Christmas decoration, one said, "Let's go to Walt Disney." With Walt's delightful "It's a Small World" at the New York World's Fair still twirling in our heads, we were sure Disney Productions at Burbank, Calif., would have an idea as different as tomorrow.

The fantastic Christmas mobile you see pictured here and on our cover is Disney's answer to our request. You build it and we guarantee it will be the talk of your neighborhood.

The original, shown on the cover, was a natural for Fred MacMurray, a real do-it-yourself buff. With the help of such lovable characters as Mickey Mouse, Donald Duck, Pluto, Bambi and Dopey, who

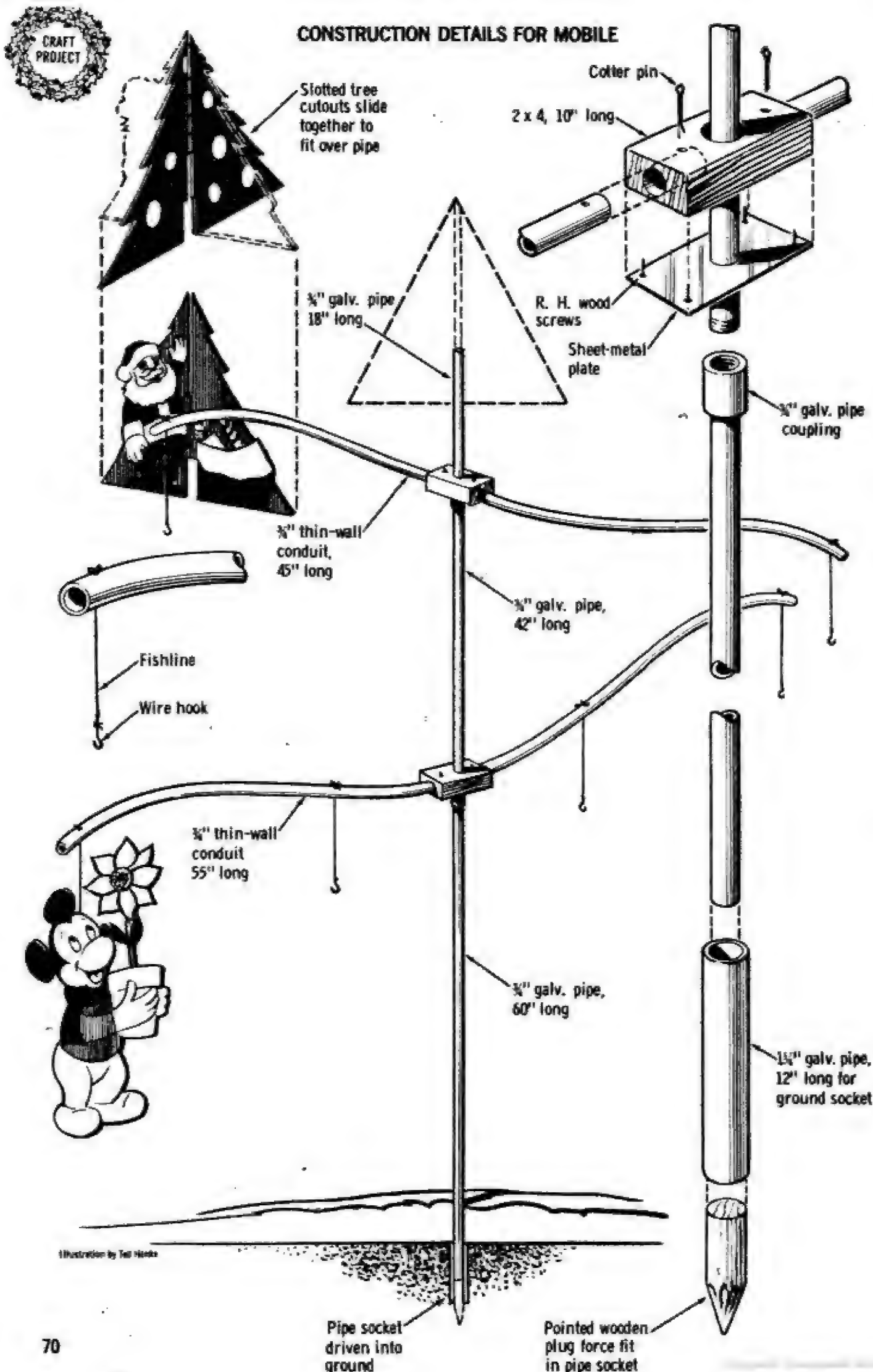
agreed to "hang around," Fred found time during the filming of his newest Walt Disney movie, *Follow Me, Boys*, to put it together and pose for our cover photo.

Incidentally, the mobile will be on display throughout the Christmas holiday

(Text continues on page 72)

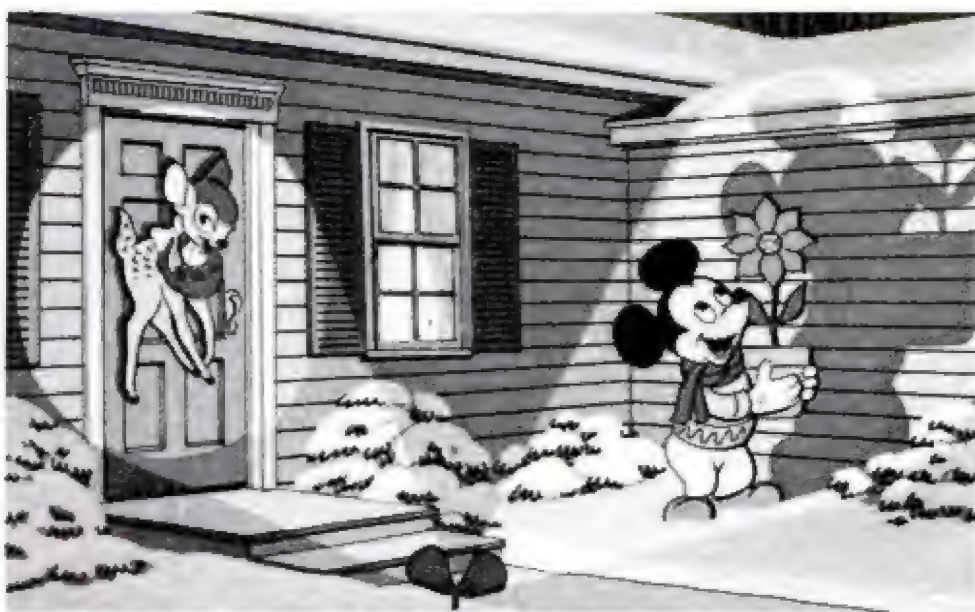


CONSTRUCTION DETAILS FOR MOBILE



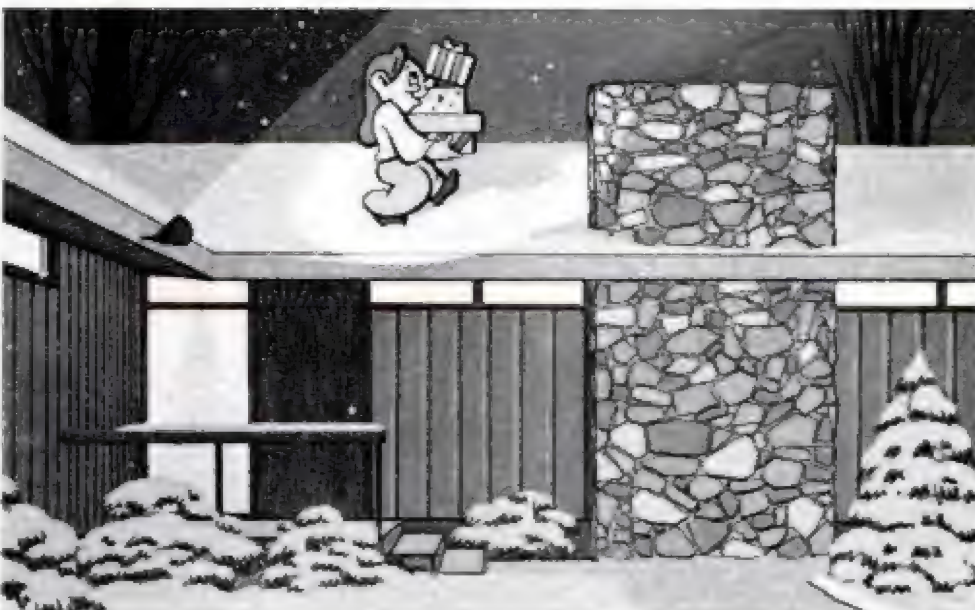


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PROJECT-A-PLAN

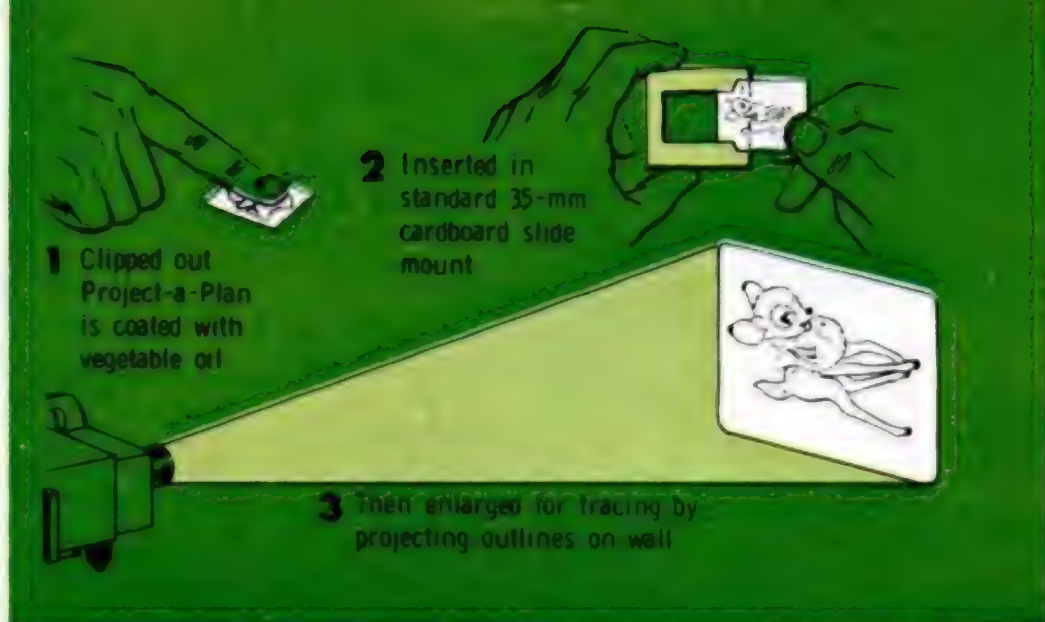
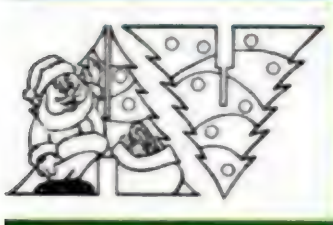
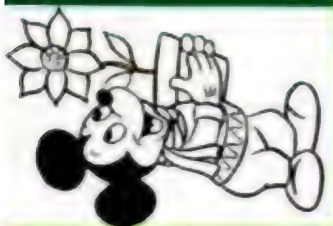
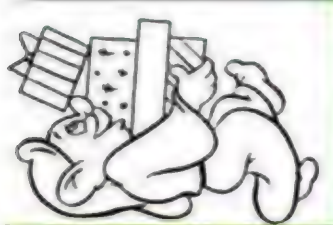
TRANSPARENCIES

FOR ENLARGING

Illustrations by Arthur D. Gustafson. All figures © Walt Disney Prods.

APART FROM THE MOBILE, the Disney cutouts can also be used individually to add the Christmas spirit to your home. Here are three examples of how Pluto, Mickey, Bambi, Dopey and the others can be used to decorate the roof, doors and lawn when made giant size. In each case, spotlights are rigged to show them off. If they're made of plywood, be sure it's exterior grade

DECEMBER 1966



HOW TO USE PM'S PROJECT-A-PLANS

If you haven't used Project-a-Plan transparencies before, it's as simple as 1, 2, 3. First you clip the drawings from the magazine page. Next you rub the fronts and backs with a little vegetable oil to make the paper transparent. Finally, you insert the paper "film" in a regular 35-mm cardboard slide mount. You now have a black-and-white slide that can be used in any 35-mm slide projector which permits you to blow up the pattern to the size you want and trace off the projected outlines right on your material for jigsawing

season on the grounds of the Children's Hospital in Hollywood.

The slightest breeze makes Mickey, Donald and the others swing and turn as they slowly go round and round in true mobile fashion. And when lighted from below by a couple of bright spotlights, the lively painted cutouts and the tinsel wrappings on the pipe make a most effective and colorful night display.

Though it stands nearly 12 feet tall, the simple pipe framework

(Please turn to page 190)





Drivin' with Dan

Why don't more top NASCAR drivers drive at Indy? Is there any advantage in disc brakes for the average motorist? Is the track at Le Mans too dangerous? Dan Gurney answers these and other provocative questions



Dan Gurney stops in at *Popular Mechanics* to examine car-test photos with auto editor Bill Kilpatrick after big victory in 200-mile road race at Bridgehampton, N. Y.

Q. I'm thinking about buying a Mustang, but I can't decide whether to order a fastback or the conventional notchback. Which would you buy? Are there really any handling and driving advantages in the fastback?—Peter Johnson, Minneapolis.

A. I plan to buy a notchback. I won't say what make. Actually, my guess would be that at really high speeds, the notchback might handle a little better. Also, you might want to consider that highway patrolmen seem to pay more attention to fastbacks.

Q. I understand that you and Jerry Grant were disqualified at Le Mans because you had to add water twice inside of 25 laps. Inasmuch as this was caused by a broken radiator hose—which was easily replaced—isn't this a silly rule?—Forrest O'Brien, Pittsburgh.

A. A rule is a rule and the same for everyone in the race. They apparently don't want a bunch of disabled cars poking around the long (8½ miles) circuit trying to finish in spite of leaks and other troubles. The road is narrow and visibility is poor enough, particularly at night, without adding the problems that such cars would contribute.

Q. Why do they let all those little cars run along with the big Fords and Ferraris at Le Mans? I heard that some of them are 100 mph slower.—Gary Morris, Battle Creek, Mich.

A. Some are probably as much as 70 mph slower. However, Le Mans is a race with great tradition and because of it, I don't expect any changes in the foreseeable future.

Q. I read where a Detroit safety engineer said that disc brakes offer no real advantages for the average motorist and aren't worth the added cost on cars used mostly for ordinary driving. Do you agree?—H. C. Scott, Sioux City, Iowa.

A. I agree that discs seem to be best under the extreme heat conditions encountered in racing. However, as usual, there are exceptions to this rule. In stock-car racing, for example, they still rely on drum brakes because they are superior on smaller wheels.

Q. Why don't more top NASCAR drivers drive at Indy? Wouldn't Richard Petty and Fred Lorenzen do better there than some of those second-string USAC chauffeurs?—Ed Sanders, Greensboro, N. C.

A. I think they undoubtedly would do better than "second-string USAC chauffeurs." Yet they certainly would be subjected to an extra strain. At Indy they would have to learn to do a lot of things differently—things they now are used to doing as almost second nature in their own racing. Also, they would have to leave their own championship cir-

cuit at a time during which there are two major races (Darlington and Charlotte).

Q. How many times did you shift gears at Le Mans?—Allen Hill, Colorado Springs, Colo.

A. Although Le Mans is a very long circuit, it doesn't require as much shifting as many much shorter circuits. This year I shifted about 16 times per lap.

Q. If you were the chief safety engineer of an automobile manufacturer, where would you direct the most effort: toward building a controllable car that would make accidents less likely, or toward a car that would protect passengers in an accident.—Henry P. Yost, Cleveland.

A. Toward a more controllable car. But I don't think we are required to make a one-or-the-other choice. I think both areas should receive consideration. There is a limit to how much protection can be built into an automobile. A lot of adventurers have gone over Niagara in some pretty stout rigs and didn't make it. In a car—like Niagara—it's best not to go over the falls.

Q. Why are disc brakes offered most often on front wheels only?—Stewart Karas, Long Beach, Calif.

A. Most of the braking effort is needed on the front wheels. It may be a cost consideration, too.

Q. Could you have set the lap record at Le Mans if your car had had an automatic transmission?—Wendell Bingham, Great Neck, N. Y.

A. Certainly. Why not? When it comes to lap records, the stopwatch is what's important, not the type of transmission used.

Q. What do you think of left-foot braking? Do you use it?—Jack Thompson, Tucson, Ariz.

A. I think it has an advantage in that there is less time lost. The foot can be poised and ready to brake sooner, which in racing allows you to follow a little closer with the same safety margin. I have tried it, but do not use it because my left foot is not trained enough and I don't trust it. If I ran oval tracks all the time, I would definitely use it.

Q. I've attended the drivers' meeting at Indy, and it always seems like it's put on more for

the public than for the drivers. At Daytona, the drivers' meeting is closed to the public and I understand the track officials really lay down the law. Does Indy have another meeting that's just for the drivers?—C. D. McCarver, Norfolk, Va.

A. No, they don't, and this is a very touchy subject. Frankly, if I had to choose—having attended both meetings—I would say Daytona is the better of the two. I'm sure, on the other hand, that Indy will change for the better. After this 1966 race, several of us suggested that Indy take a page from Daytona, particularly in showing movies of previous accidents and pointing out some of the mistakes that can be so easily made.

Q. At Indianapolis I understand you have to drive the race on the same brand and type of tires you used when you qualified. In stock-car racing you can switch brands and types of tires as the track and weather indicate. Would you favor a more liberal tire change rule for Indy?—Bill Blain, Trenton, N. J.

A. No. They don't need any more variables at Indy. The rule is there as a safety precaution. It enables the tire companies to maintain a control and safety margin that less experienced gamblers might tamper with.

Q. I understand Jim Clark won't drive at Le Mans because he regards the track as too dangerous. Apparently you don't agree.—Phil Crossman, El Centro, Calif.

A. I agree that it is a dangerous track, but I don't believe Jim actually thinks it's too dangerous for him. He has a contract with Lotus and they have no car in a position to dominate that particular race. Consequently, they pass it by. I run there because now that American teams are contending, I like to be a part of it.

Q. The Wall Street Journal called Stirling Moss the greatest driver who ever lived. Would you buy this?—Abe Chandler, Wichita, Kans.

A. What, the Wall Street Journal?

If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 62).

Where even Santa gets ideas

When department-store windows in your town come alive with snowmen, dancing elves, and polar bears that tootle trumpets, chances are they're from this Chicago workshop that makes the North Pole look a little drab.

By MORTON J. SCHULTZ

SANTAS LIKE THIS ONE are year-round companions of George Silvestri, who dropped a busy law practice to concentrate on something even more important: Christmas. He dreams up ideas that keep 175 craftsmen busy all year

LAST-MINUTE CHRISTMAS RUSH is on in Santa's workshop. All tools and other equipment are carefully scaled to the size of the figures. An added attraction is visible below. It's another workshop—but for mice only



TIME STANDS STILL in a particular building in Chicago. It's always Christmas there.

Fluffy polar bears toot horns and clash cymbals. Brightly dressed snow people and white-vested penguins play together against a background of glistening snow and white-capped mountains. Rembrandt's "Adoration of the Shepherds," twice as large as the original canvas, stands in bold, three-dimensional tableau like a living group of reverent people. Stained-glass windows blaze with colored light as they are struck by the sun.

Of course, Santa Claus is there, too. The jolly 15-foot giant waves an eight-foot arm as he bobbles up and down four levels of a seven-story building in the gondola of a 30-foot balloon.

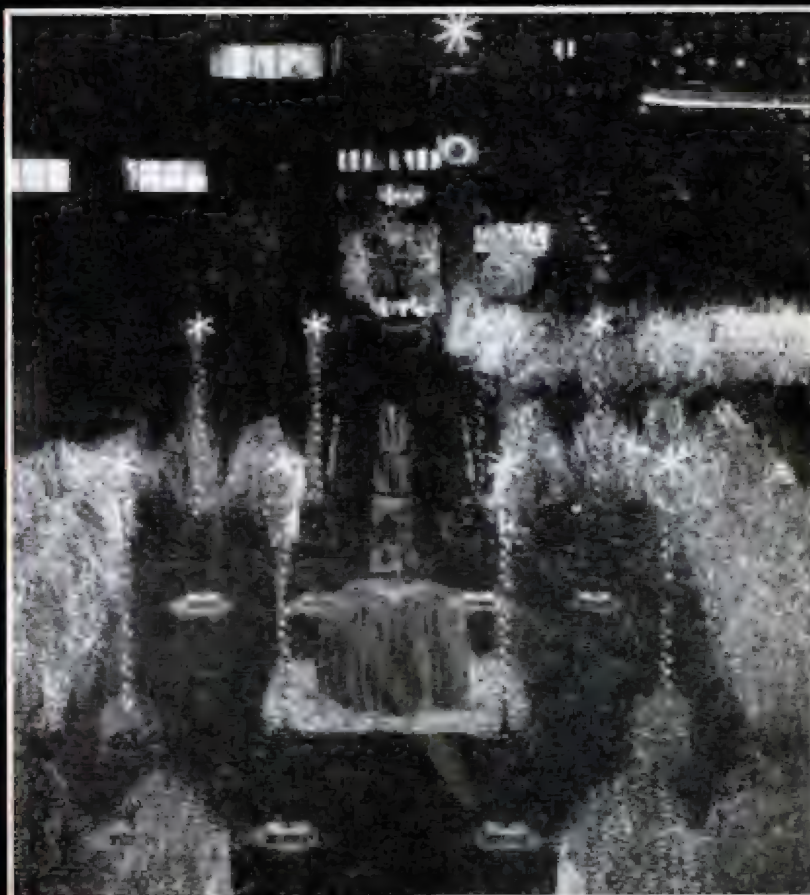
All these Yuletide splendors and more are housed in the remarkable plant of the Silvestri Art Manufacturing Co., where Christmas comes to life for thousands of city dwellers all across the nation. This December, as you stroll along New York's Fifth Ave., Detroit's Woodward Ave., Chicago's Michigan Ave., Miami's Biscayne Blvd.—or any street where there's a department store of appreciable size—you're bound to see some of the displays just described. They were made by the 175 ingenious craftsmen of this spectacular "Santa Claus' Workshop."

Santa, in this case is George Silvestri, a former attorney who quit a busy practice to pursue a lifetime dream of putting on unusual shows.

"There's no limit to the guy's imagination," says Bob Vondran, the company's chief troubleshooter. "He'll try anything he thinks will give people a bigger laugh or a more aesthetic feeling for Christmas."

Vondran—and everyone else—won't forget one outdoor winter scene that was made for a Miami department store several years ago. "It didn't look

THOUSANDS OF TINY LIGHTS
made Constitutional Plaza in
Hartford, Conn., look like this last
year. Silvestri's son has worked
out a way to make light clusters
appear to dance in time to music





ADD THIS FIBERGLASS SECTION to 59 others and you have a 70-by-50-foot "stained glass" Nativity scene, biggest display of its kind



SANTA MINUS RED SUIT gets work done on his motor, which activates shafts running up leg. They, in turn, make his right arm wave

real enough to suit the boss," troubleshooter Vondran recalls, "so he told us to coat all the figures and scenes with sugar and to use real candy where we could. Some of those genuine candy canes we put into the windows were 10 feet high.

"Well, a few days later, the store manager called to report that every ant in the Miami area was aboard the scenery in his windows."

Silvestri rushed a couple of his people to Miami, where they did a fast exterminating job and sprayed the displays with clear lacquer.

The incident didn't faze Silvestri. "If you don't try something, you'll never know how it will pan out," he says philosophically.

Sugar and candy aren't typical raw materials. Usually Silvestri's crew works with latex rubber, plaster, papier-mache, electric motors, cranks, levers, gears and relays. While the workshop turns out all kinds of animated displays, Christmas accounts for more than 80 percent of the subject material. Last Christmas in Altman's New York windows, straight-backed Victorian soldiers marched in perfect cadence to the *Nutcracker Suite* as cannons blasted 21-gun salutes; Detroit families walked around a North Pole erected in the big J. L. Hudson Co. store and watched scores of elves making ready to send Santa on his annual rounds; Dayton, Ohio, shoppers found Huckleberry Hound, Yogi Bear, Pixie and Dixie at Lazarus', running into each other like Keystone Cops in their rush to make Christmas candy.

This year, shoppers in New York will stand in front of the six Altman windows to watch French poodles, cocker spaniels, St. Bernards, German shepherds and other pedigrees romping in the snow as they celebrate a "Dog's Christmas." Unless you look closely, you won't be able to tell that these "pups" are animated, because their coats are made from specially imported Spanish lambskin—closest to dog fur.

In other cities, people will be entertained by Donald Duck, Pluto, Mickey Mouse and Dopey as they bang out a Beatle-type version of "Deck the Halls," keeping a steady rhythm with their instruments as their feet tap to the beat.

Much of the Silvestri touch of realism was conceived by Guido Rabechini, who achieved world acclaim as a sculptor before his death and who served as Sil-



WALT DISNEY'S DOPEY has his "brains" in his back. A three-gear arrangement, shaft-driven, causes his arms to go up and down



ARM ACTION IS VITAL, for this Dopey will become the drummer in a naisy "four-man combo" that may make you think of Beatles

vestri's head sculptor for many years. His designs were huge, some achieving a height of more than 30 feet, such as the Nativity scene made five years ago for Carson, Pirie, Scott & Co. of Chicago. The huge sculptured figures were placed on a ledge above the store's entrance and had to be reinforced against gale-force winds with guy wires.

Rabechini's methods play a major role in the company's production of statues, which are first molded in clay. The mold is then encased in a split plaster mold, which, when it hardens, is filled with the modeling substance—in most cases, latex rubber. When the material hardens, the plaster mold is stripped away, and the realistic people and creatures are animated with motors and cams, then painted in lifelike hues.

Silvestri craftsmen constantly strive for realism. During last year's show to the trade, one Silvestri scene portrayed two little girl skunks on their knees saying their prayers. On the bed was a baby skunk—a real one, placed there as a gag by Silvestri's men.

As visitors passed the display, they stopped—some admired, some didn't give it a second glance, some made notes.

And then one caught himself up short. "Hey," he yelled, "the little one moved."

Fur and molded rubber make for realism. So do sensitive switches and motors that allow figures to move in perfect synchronization to one another and the scene. It is not unusual for one caricature to accomplish as many as 50 perfectly synchronized movements during the cycle of a particular set of events.

One job that taxed even the ingenuity of these craftsmen, according to Silvestri, was the gigantic Nativity display that Chicagoans will find for the second year over the entrance to Carson, Pirie, Scott & Co.

The largest "stained glass window" in existence, it stands 70 feet high by 50 feet across and is held together by four tons of structural steel.

First, a material that could stand tremendous strain, both from the elements and handling, and yet have a stained-glass appearance, had to be found. Fiberglass proved the best because of its tremendous strength, and the fact that when paint is applied it looks like the real thing.

But fiberglass alone cannot withstand

(Please turn to page 198)

An illustration of a spacecraft rescue sequence in space. In the upper left, a portion of a spacecraft is visible with the label 'P-2'. Below it, an astronaut is shown floating in space, labeled with a circled '1'. To the right, a small, inflated rescue capsule is shown, labeled with a circled '2'. Further right, another rescue capsule is shown with an astronaut inside, labeled with a circled '3'. In the lower right, a third rescue capsule is shown with an astronaut inside, labeled with a circled '4'. The background is a dark space filled with stars and a large, curved, reddish-brown structure, possibly a planet or a large space station, in the upper right.

How to get a good man down

What would happen if a spacecraft failed? Would our astronauts be stranded in space? Here are some of the rescue systems engineers are working on to bring them back alive.

By KEVIN V. BROWN

Illustration by Edward Valigursky

THE BEST-LAID PLANS of mice and spacemen often go astray.

This old bit of wisdom, updated for the space age, can hardly shock anyone who has followed the flights from Cape Kennedy. We've been lucky. We've had some near misses, but we haven't lost a man yet. We had at least one mission, a Gemini flight, when our astronauts were down to their last reentry system. What if they had lost that? Would we lose the astronauts?

The persistent rumor, begun at the beginning of the space race and still current today, is that the Russians actually did lose one or more men before Yuri Gagarin became the first man to survive an orbit.

The whole point is that space flight and perfection are not synonymous. Some day we will have more than a near miss. Some day our astronauts actually will lose their last reentry system or suffer some other catastrophe that will

1. In emergency, astronaut abandons damaged spacecraft after donning plastic escape suit like coveralls.

2. When ripped in, he initiates foaming process. Fed from two cylinders, foam fills bottom of bag.

3. Next, astronaut uses attached gunlike jets to orient escape capsule with foam-side toward earth.

4. When oriented, he fires reentry bursts from jets to place capsule into proper deorbit trajectory.

5. Now astronaut just rides package down. Foam protects him from heat and floats at splash down.

5



MOOSE PARACHUTE billows out automatically at preselected altitude, carries astronaut down safely



RADIO SIGNALS from equipment attached to MOOSE package give rescue aircraft something to home on

stop them from coming down normally.

Scientists have been working on it. They suggest several ways of getting the astronauts down safely if their spacecraft is destroyed or damaged beyond safe repair. Their emergency space-rescue systems fall into two basic groups, those in which the astronauts get themselves down or somebody goes up to get them.

The self-rescue types include the MOOSE system (for Manned Orbital Operations Safety Equipment) proposed by General Electric Co. (See page 80.) It consists of a package, much like an inflatable liferaft at sea, that is inflated with foam in space and, aided by the auxiliary equipment tied to it with lanyards, it is ridden down to earth.

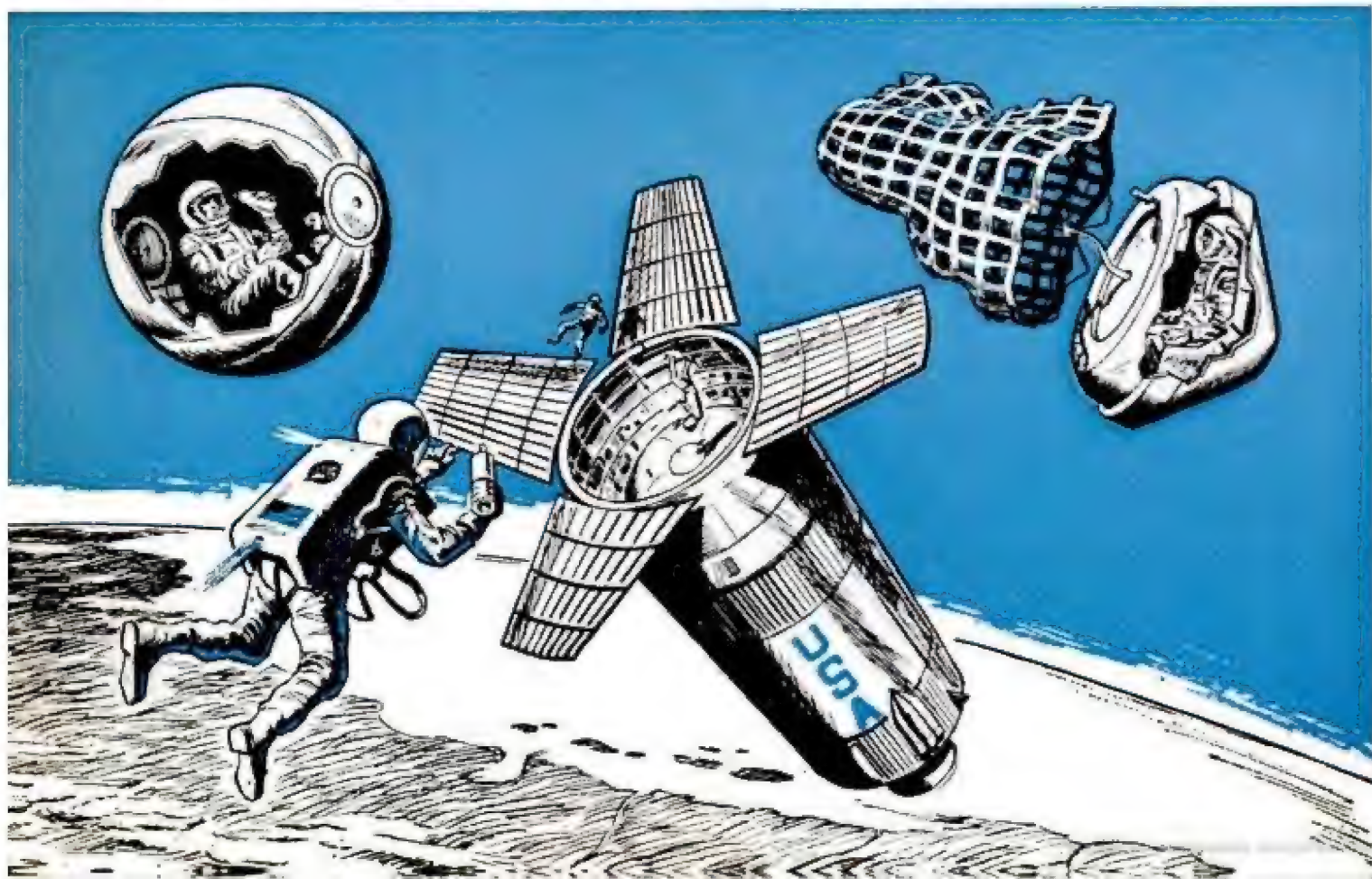
To start his escape the astronaut steps

into a transparent mylar bag, slips into a harness to orient his body properly inside it and zips the bag closed. He then activates the foaming process. The components, contained in two cylinders, are fed from their pressurized containers through a generator head which mixes them and injects the mixture into the bag's compartments. Within a few minutes, the foam shapes the bag to reentry configuration and hardens. The foam, the scientists say, is hard enough to withstand the heat of reentry as well as does the metal on a spacecraft.

The astronaut then uses a small rocket gun to orient the MOOSE to deorbit attitude, with the foam side facing the direction of flight, and retrofires to deorbit.

The rest is automatic. Radio signals

OTHER SYSTEMS for aiding stranded astronauts include bubblelike cocoon (left) and spent booster stages with emergency gear, both keeping astronauts alive temporarily, and self-rescue lifeboat (right)



and radar chaff are initiated at selected points for ground tracking, and a parachute is deployed through a baroswitch (which acts on barometric pressure) at a preselected altitude. If it lands in water, the foam floats, and smoke bombs and dye markers are deployed.

Another self-escape system, proposed by G.E., is more like a lifeboat than a liferaft because it is already full size when built into the spacecraft. In an emergency, the astronaut climbs into the lifeboat, closes the hatch and ejects from the crippled spacecraft. The landing sequence is then almost identical to reentering with a MOOSE liferaft. Attitude jets orient the lifeboat for reentry and retro-rockets initiate the deorbiting sequence.

The self-rescue systems seem to be the most feasible way of getting stranded astronauts down, mostly because of the cost of sending up an altogether new booster and spacecraft and rescuing astronauts. But space engineers are working on this angle, too.

One of the problems is keeping the stranded astronauts alive until a rescue booster can be readied and the launching pad—namely, the Earth—rotates into the right position for a well-aimed launch. Just throwing a rescue spacecraft into orbit helter-skelter isn't of much use. It has to go into an orbit that gives it a

reasonably good chance of rendezvousing with the stricken spacecraft quickly.

While all this is going on, the stranded astronauts are in a desperate situation. So scientists suggest ways of giving them temporary shelter until rescue comes. One method, again from General Electric, offers an inflatable "cocoon," a package that will inflate into a pressurized ball. It uses selected synthetic materials having the unique property of diffusing into space the carbon dioxide and water vapor given off by the astronaut at a far greater rate than the oxygen carried for his breathing — eliminating the equipment needed for atmospheric control.

Another suggestion, from Douglas, would equip spent stages of boosters as way stations so that astronauts wearing backpacks could leave their stricken crafts and make their way to the orbiting booster to find emergency equipment and supplies.

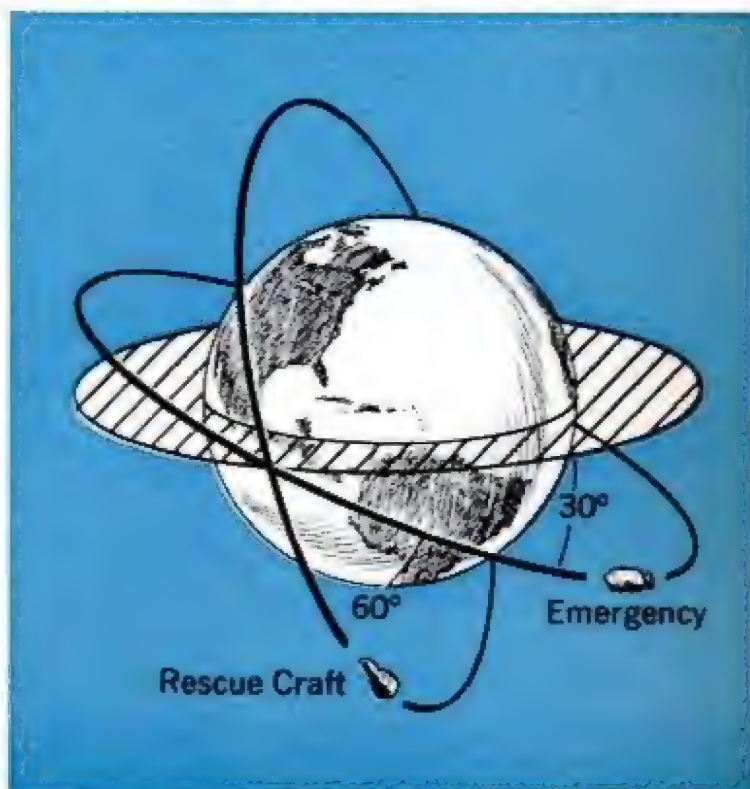
Both of these methods still imply that a ground-rescue team has to come up and get them, but either would keep them alive until the team gets there.

Any of these rescue systems, if started now, would still take about five years to perfect. Until then, our space flights have to go right on being perfect. ★★★

FULL-SCALE MOCK-UP of cocoon which would inflate in space and sustain astronaut until help comes



EARTH RESCUE is difficult because timing of rescue launch must provide proper orbit for rendezvous



SO YOU DON'T REMEMBER PEARL HARBOR?

TWENTY-FIVE YEARS ago, on December 7, 1941, a day that "will live in infamy," a sneak attack rocked this country back on its heels. Despite plain warnings from Japanese history, broken codes, and our own top naval airmen, we simply refused to believe that the Japs might play dirty and attack us without formal notice. We got caught flat-footed by a stunning hit-and-run carrier raid that sank most of our battleships and left a shambles of burning ships, planes and barracks at Pearl Harbor.

Did the 3000 Americans who died in that holocaust give their lives in vain? Did we learn anything from it? Could it happen again today?

Answering the last question first—it probably could not happen now. Today our Navy is nearly unchallenged, at least on the surface of the sea. The battleship has gone to the boneyard, replaced by the aircraft carrier. The atom bomb now hangs over the world like the sword of Damocles, and the Polaris submarine, the most awesome weapons system ever devised by man, has become our Sunday punch. It is so powerful that the only way it can justify its existence is by its never being used.

So long as the NATO nations and the Russians are the only ones able to deliver a sneak attack there prob-



ably won't be one. There is too much to lose for a major power in an atomic war, no matter who wins it. A sneak attack today would provoke instant and devastating retaliation. Neither the major free nations nor Russia are stupid enough to start this.

But atom bombs are now being developed by Red China, Israel, Egypt, France and others. When they become common property of a dozen nations, no one can tell what may happen. Some nation which has the bomb, and not much else, may decide to shoot the works, figuring that it doesn't stand to lose much no matter what happens. A sneak attack by an irresponsible nation will not destroy the United States. But it will make Pearl Harbor look like a campus riot by comparison.

Did we learn anything from Pearl Harbor? Sure. We learned how to defend ourselves better against *that kind* of attack. But that kind of attack by ships or planes has been outmoded now; and I doubt that we would be caught flat-footed even by a sneak atomic attack. Our continental air defense and DEW line should prevent that. And even if they didn't, our fleet of Polaris submarines is invulnerable, hidden in the depths of the seas, cocked and ready.

But the big lesson we should have learned at Pearl

**By Rear ★★
Admiral
D. V. Gallery**

USN, Ret.

Painting by
Ed Valigursky



Harbor has little to do with fleets, airplanes or the weapons of war—atomic or otherwise. That lesson is that war is not a game played by a formal set of rules like the Geneva Convention. War is a deadly business in which nations put aside morals and try to settle their differences by force. There is only one "law" of war that has any teeth in it. That is: "Don't lose it." Judging by the Korean war and by what we are doing in Vietnam, we didn't learn this lesson very well.

We still seem to think that war is a game with rules that are enforced by an umpire called "world opinion."

Our country is now the most powerful in the world, and as such it incurs responsibilities, whether we like it or not, for helping backward peoples and for keeping order in the world, sometimes by force. We would also like to be the best-loved people in the world, but those two things don't go together. We give away billions in foreign aid, but the poor hate the rich—and the police—the world over. We are the rich and the cops to the rest of the world. Their feeling toward us is well summed up in the words, "Yankee, go home." It is absurd to try to change this feeling, when we have to use force to keep order, by handicapping our troops and making them fight a gentlemanly war. But so far this is what we are doing in Vietnam.

Our enemy follows no rules of God or man, but we are trying to play the game by Marquis of Queensberry rules. We keep escalating *gradually*, apparently in the hope that we can just barely win the war without hurting anybody too much!

We are scared stiff by a myth called world opinion, and pay more attention to it than we do to trying to defeat the enemy. Actually, world opinion is simply the consensus of several dozen top reporters who are more interested in sensational stories than they are in the outcome of the war.

A year ago, our marines used tear gas to smoke out a gang of guerrillas from underground caves where they held women and children as hostages. This saved most of the women and children. But world headlines said, "U.S. uses gas against civilians."

Our infantrymen, ships and planes enter battle now tied down by all sorts of restrictions. Their targets are selected for them by mechanical brains and computers in the Pentagon. They fight for their lives under a set of ground rules made up 8000 miles away. Any time one of the local commanders does something on his own hook, in the heat of battle, he has two things to worry about: (1) How will this affect the lives of my troops? (2) What will the whiz kids in the ivory tower back home say about this? Military decisions are being made in the Pentagon with an eye on the Gallup Polls and their effect on the next election rather than immediate results in the war.

Many months ago, the Joint Chiefs of Staff wanted to bottle up Haiphong Harbor with mines. Mines do not blow up orphan asylums or hurt women and children. But we didn't do it, in deference to "world opinion." It would violate international law and might offend some of our friends and allies who carry on a profitable trade with the enemy!

We had a good example of the enemy's respect for rules a few months ago, when they paraded some of our captured flyers through the streets in handcuffs to be spit on by mobs. They even threatened to try our men for waging aggressive war and shoot them. We were quite properly outraged at this threat. However, we should remember that, after all, we started that kind of stuff at Nuremberg when we tried and hanged the losers in World War II.

We are much too deeply committed now to the war in Vietnam to settle for anything

(Please turn to page 196)



Lest We Forget: WHAT HAPPENED TO U.S. AT PEARL HARBOR

KILLED: 2403

NAVY:	2008
MARINES:	109
ARMY:	218
CIVILIANS:	68

WOUNDED: 1178

NAVY:	710
MARINES:	69
ARMY:	364
CIVILIANS:	35

**SHIPS SUNK OR
BADLY DAMAGED:
18**

LOST: Battleships
Oklahoma, Arizona;
target ship Utah; de-
stroyers Cassin,
Downes.

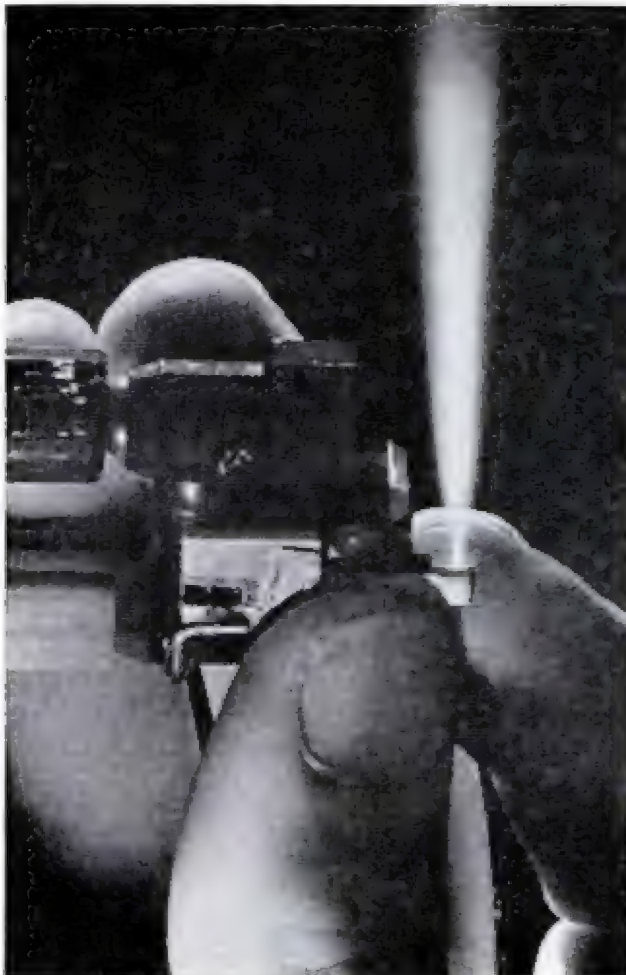
BADLY DAMAGED
BUT LATER RE-
PAIRED: Battleships
West Virginia, Cali-
fornia, Nevada, Ten-
nessee, Maryland,
Pennsylvania; cruis-
ers Raleigh, Helena,
Honolulu; destroyer
Shaw; mine layer
Oglala; seaplane
tender Curtiss; repair
ship Vestal.

**AIRPLANES
DESTROYED: 188
DAMAGED: 159**





An elegant import from Italy, the Ghia 450SS is a two door 2+2 seater equipped with a 235-hp Chrysler Barracuda V8 power train. The sports car has such luxury features as cowhide upholstery and mouton carpeting, and standard equipment includes automatic transmission, power brakes and power steering. The 450 lists at \$11,800; importer is Ghia of America, Beverly Hills.



Captured on infrared film, the beam of a new injection laser appears here pulsing from the laser—a tiny crystal of gallium arsenide (inside the metal mount held between the fingers). Its infrared light has a wave length of about 9000 angstroms. International Business Machines Corp. recently patented it.



The return from space may be made in a vehicle like this, says the Lockheed-California Co. This 30-foot wooden model is undergoing tests to see if the dartlike shape will withstand the heat and other stresses of re-entry, as well as remain highly maneuverable and, finally, land like an airliner. Lockheed is conducting the studies for the Air Force and describes this vehicle as a "preliminary design."

*That truck
ahead of
you may
be hauling
poison gas,
deadly acids —
or H-Bombs.
A chemical fire-
fighting expert tells
what happens
when this cargo
runs amok.*

High Explosives

THE PHONE CALL was the kind I'd learned to expect and dread.

A fire department 20 miles away was facing a sudden space-age emergency—a tanker-trailer parked off the freeway was leaking dangerous nitrogen tetroxide.

"I'll be there as fast as a siren and red light will get me," I said. "Meanwhile, don't go near that tanker without full breathing protection! That stuff is a deadly poison gas!"

As head of Rocketdyne's dangerous chemicals firefighting team at the time, I knew what I was talking about. Essential to rocketry and modern industry, new

By ROBERT J. MADDEN

and frightening chemicals are traveling the nation's highways. Some are explosive, some poisonous, others highly corrosive. And there was little information on how to handle them in emergencies.

My team had specialized in new approaches. Some of our methods seemed bizarre, but they worked. We were "on call" to any fire department in the Los Angeles area.

Twenty minutes after the phone call I spotted the "leaker." A cloud of red-



WRECKED TRUCK WITH FLAMMABLE GASES is a threat to firemen (left) who must use special methods to bring it under control. Leaking hydrogen (above) is allowed to dissipate into the atmosphere

on the Highways

as told to Tom Stimson

brown vapor was pouring from the tanker. Firemen were spraying water on the cloud in a futile attempt to neutralize it.

I had a quick conference with the fire chief on the scene; then my partner and I got dressed in protective clothing, strapped on our breathing gear and picked up the tools we'd brought with us: a box of Dry Ice and a plastic sheet.

We climbed onto the tanker, stretched the sheet of plastic across the leaking area and held the patch in place with

slabs of Dry Ice. The operation looked as exciting as changing a flat tire.

Within minutes the plastic sheet had frozen solidly to the metal and the leak was stopped. A new tanker was driven alongside and the cargo transferred. That ended the emergency.

This was one more case of an accident that can't happen—but does. Nitrogen tetroxide is vicious. As a liquid, it sets some combustible materials afire on contact. It vaporizes at 70° F. and the vapors are poisonous.

This dangerous chemical doesn't attack mild steel, of which the tanker was built,

HIGHWAY SAFETY

yet portions of the tank were literally rotted. The mystery was solved when I learned that the valve area was sometimes washed off with ordinary water, and water mixed with the chemical created corrosive nitric acid which had eaten into the metal. One severe jolt and the tank might have ruptured apart.

When I related this incident to a group of city officials, one of them remarked that dangerous highway cargoes are rare.

"On your way home tonight," I told him, "you may find yourself in company with a tanker loaded with a liquid that makes steel flare up like a dried-out Christmas tree, or alongside a tanker carrying 4200 gallons of hydrazine, so poisonous that it's deadly even when diluted to 100 parts per million.

"Any sudden emergency could involve one of these carriers in a wreck."

Safety laws cover dangerous cargoes but sometimes they are carelessly ignored. There was a case last year where a truck driver was unknowingly on the verge of orbital launching at any moment. He had been told only that his cargo was dangerous, so when he heard a muffled explosion in his van while in a residential area he called the local fire lads.

I could hardly believe my ears when the fireman read the driver's bill of lading to me on the phone.

"Two-stage sounding rockets en route to New Mexico. Six of them, all fueled and ready for launch. The first-stage liquids are nitrogen tetroxide and anhydrous ammonia. Second stages: solid ammonium nitrate and aluminum powder. One of the ammonia tanks let go from

WATER SPRAY directed at a leak in an oxygen tank-er creates a coating of ice that stops the leak



IGNITION OF OXYGEN that is being transferred

the pressure, and that's the explosion the driver heard!"

With ammonia on the loose, that cargo needed plenty of room—like the middle of Death Valley. The nearest substitute was the vacant 100-acre parking lot at Santa Anita racetrack. The ponies weren't running that day.

"Have the driver park his rig right in the middle of the Santa Anita lot," I barked. "Open the doors to the van, get away and stay away! I'm on my way now!"

That combination of propellants was a devil's brew, and there was close to half a ton of it on the truck. The first-stage liquids were hypergolic: they explode when brought together. An ammonia tank had blown up already. If there was a slight leak in the nitrogen tetroxide plumbing of any of the six rockets, ignition could torch the whole load. Some of the rockets might take off parallel to the ground. The others might just sit there and cook, and explode.

Fortunately for everyone, including the whole Santa Anita community, we got the touchy substances sorted out without mishap. Each of the hypergolic liquids



from leaking tanker is prevented by spray of water

finished the journey in a separate truck.

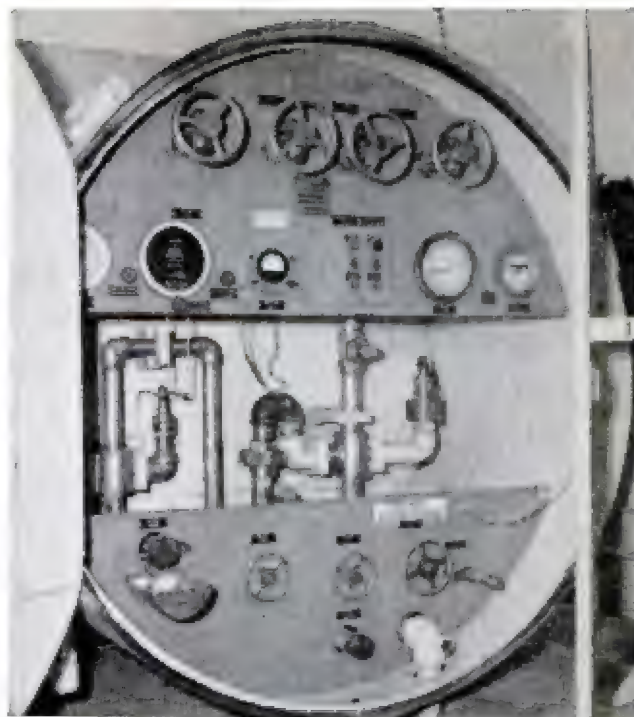
The Interstate Commerce Commission has a rule against transporting two hypergolic liquids in the same vehicle. In this case the law was broken because the rockets were "experimental"! There wasn't even a "Dangerous Chemicals" placard on the truck.

Recently Chief Roy Ludt of the Alhambra (Calif.) Fire Department was curious about the number of hazardous cargoes passing through his area and he made a spot check on the San Bernardino Freeway. He was aghast to count 18 loaded cryogenic tankers (liquid oxygen or liquid hydrogen) in an hour.

This heavy traffic may have been unusual; my own information is that ordinarily no more than two or three such tankers roll on that freeway per hour, 24 hours a day—plus an equal number on the San Diego Freeway, across town.

These figures don't include *all* hazardous cargoes, of course. I'd guess that a complete count, including items like bulk industrial poisons and aircraft tip tanks loaded with napalm, total about one per minute on each of those busy freeways.

DECEMBER 1966



REAR OF FLUORINE TANKER is equipped with gauges that warn driver of any danger when on the road

Chief Ludt, along with some other chiefs, is converting his department's self-contained breathing apparatus from bottled oxygen to bottled air. It's safer. "Some chemicals we are expected to fight can turn a fireman into a flaming torch if oxygen escapes from his mask," he says.

Cryogenic liquids—gases chilled to a liquid state, are transported in huge vacuum-jacketed pressure vessels mounted on wheels. Hydrogen, for instance, must be kept at minus 400° F. to remain liquid. Hydrogen has the highest energy of any chemical fuel and is the easiest to ignite. Two loaded hydrogen tankers overturned in the Los Angeles area in the last 12 months. I've handled as many as three hydrogen leakers in a day.

The hydrogen "incident" that scares me most is when this product heats up and expands. Then a relief valve on top of the tanker pops open and a white cloud of frigid hydrogen gas pours out. Almost anything, even static created by the discharge, could explode the cloud. I've had to contend with this only once, fortunately on a lonely road in Ventura County. We stopped all traffic for a quarter of a mile in both directions and held our fingers crossed for the long four hours that the hydrogen needed to blow off to atmosphere. There was no other cure.

Liquid oxygen is just about as dangerous. Among other weird properties, it converts asphalt pavement into a high

HIGHWAY SAFETY

explosive so touchy that a slight blow will detonate it. When an oxygen tanker was wrecked in Utah, the wheels were blown off a fire truck as that vehicle rolled across the oxygen-impregnated pavement.

The usual "cure" for an oxygen leak is to spray the leak with water. This is turned into ice by the super-cold oxygen, building up a plug that seals the leak.

Once when I was helping stop a leak in a LOX tanker in a Los Angeles suburb, we heard a loud explosion behind us and looked around to see a brand-new city pumper on fire. The wind had changed direction and drifted some of the oxygen down to the pumper, 350 feet away. Breathing the enriched atmosphere, the pumper's engine had backfired and burned up its air cleaner, oil bath and ignition wires. The vehicle might have been totaled if more oxygen had reached it.

For some odd reason, oxygen is classed as a nonflammable compressed gas, and a LOX tanker need carry only a "Compressed Gas" placard. Fire departments should never be fooled by this.

Similarly, anhydrous ammonia has the same classification, with no requirement for a "Dangerous" or "Poison Gas" placard. The fact is that anhydrous ammonia is flammable and explosive when mixed

with air, as happens during a leak. It is so irritating it can asphyxiate. Its allowable safe concentration is 100 parts per million.

Informative placards on a vehicle are important; otherwise a fire crew can't handle an emergency with intelligence. As only one example, consider what happened one rainy afternoon when a truck driver noticed white smoke pouring from his van and phoned the fire department.

A unit responded and began wetting down the cargo with a hoseline. Immediately the smoke increased and explosions began to occur. Not until then did the firemen learn that the truck was carrying drums of metallic sodium. Water was the worst possible remedy, for this lightweight metal explodes when hit by water. A sodium fire is best fought with a dry extinguishing agent, or may simply be allowed to burn itself out.

There are many stories about sodium, though I suppose the classic is the time when radioactive wastes from an AEC installation were being disposed of at sea. One metal barrel wouldn't sink, and so the bargeman shot it full of holes. All sorts of things began happening when seawater penetrated inside. The barrel skittered around on the surface, zoomed into the air several times, and finally jumped back onto the barge, spitting smoke and fire in all directions.

The terrified bargeman dropped his rifle, cut the tow rope with an axe, jumped overboard and swam full speed for the tug! The barge burned to the waterline. The barrel had contained sodium.

One of the worst of the new chemicals that a fireman may encounter is chlorine trifluoride, or CTF. It's so dangerous that it's shipped only in "one-ton" cylinders, each holding 1000 pounds of product.

Not only is CTF highly poisonous, it's so reactive it sets many materials on fire, even moist concrete. Used mainly in rocket propulsion, CTF becomes a gas at above 53°F. if not confined. It is a fairly common cargo on railways and highways.

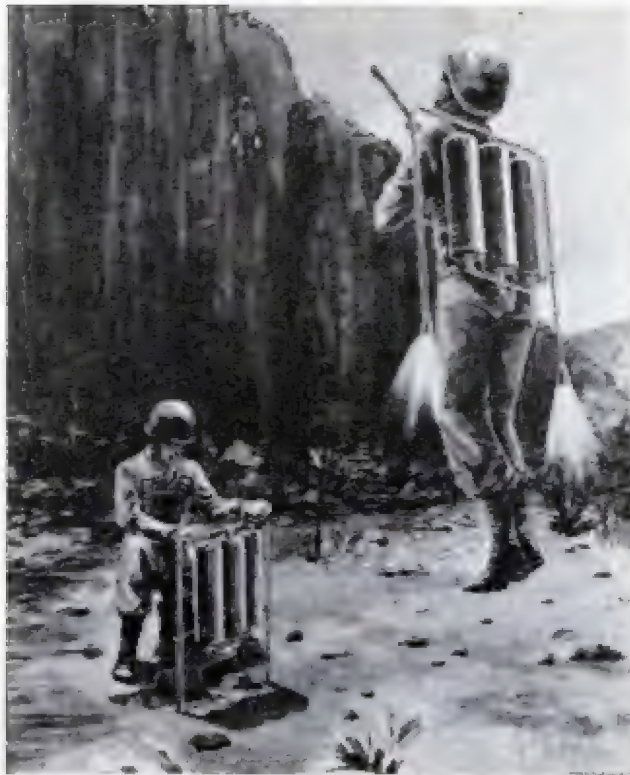
A CTF cylinder is strong enough, but its Achilles' heel is the two valves at one end. A valve can leak. I suppose I've replaced more faulty CTF valves than anyone else. It's a job no one seems to want.

To do the job safely calls for two items you'd never suspect: a large sheet of

(Please turn to page 200)

CHEMICAL FIREFIGHTER Robert Madden (left) and co-worker in protective garb needed for their work





Flying infantrymen may one day ride on backpack rockets that use water as one of their main propellant ingredients. United Technology Center scientists have conducted test firings of small experimental rocket motors which burn a solid fuel and water as an oxidizer. Shown: Two soldiers ascending a cliff while a third fills an oxidizer tank.



Eight cards, three by five inches, can carry the entire text of a 500-page book in a system developed at Battelle Memorial Institute. The books (or magazines), microfilmed and printed on the cards, are read by use of a projection machine, as shown.



She's enjoying an air massage at home without interruption of her other activities. The plastic helmet is alternately filled with air under pressure, then exhausted of air. That action gives the user of the new German machine a brisk scalp massage.

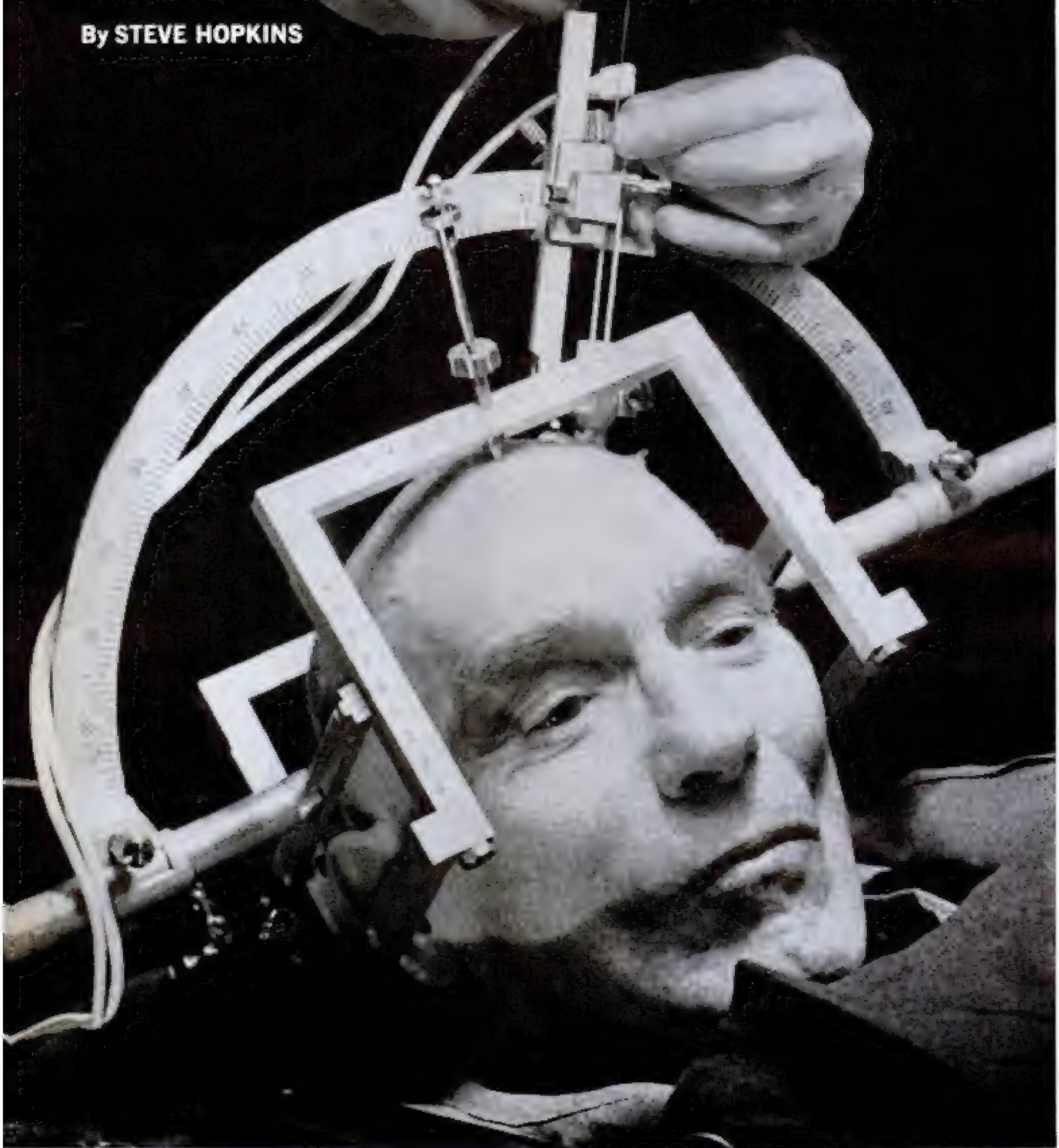


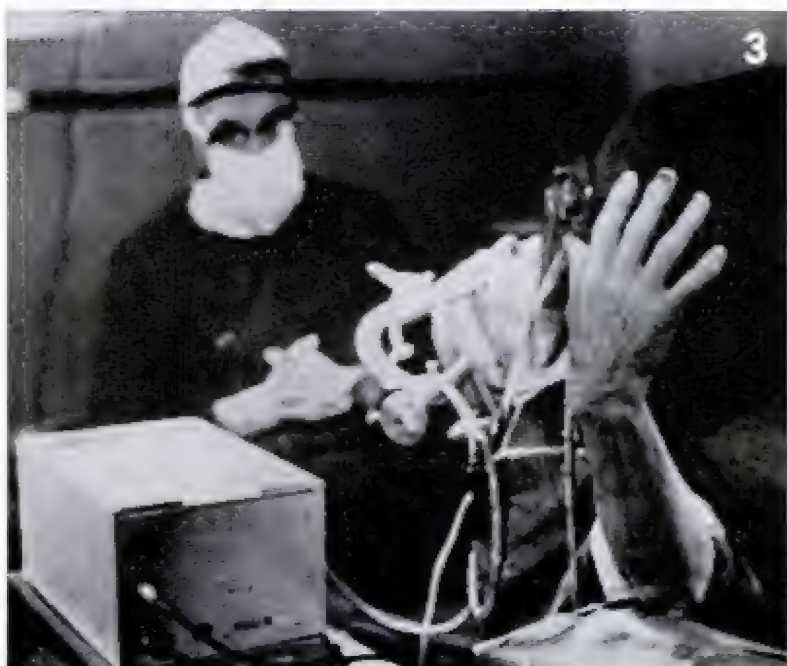
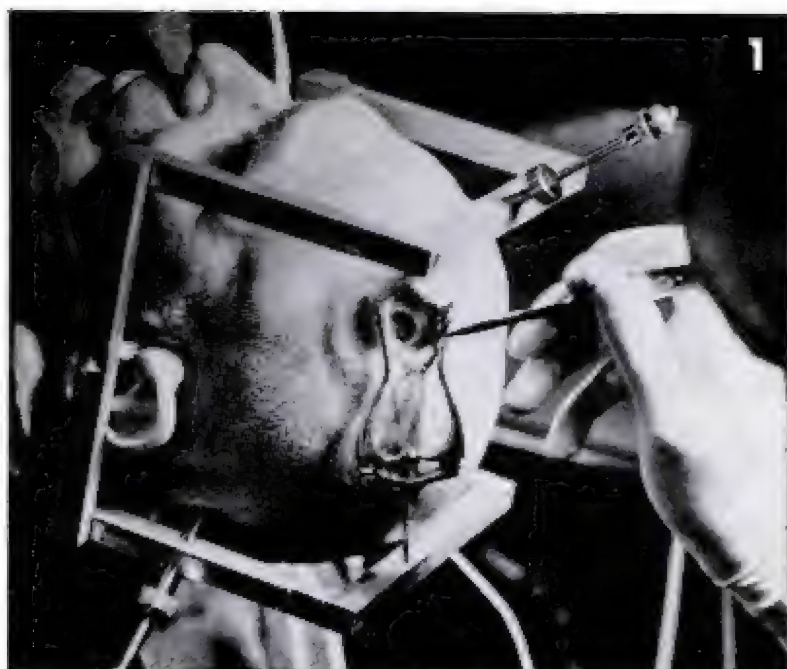
Air-driven boat is helping the U.S. Geodetic Survey chart offshore Alaskan waters. The craft explores unknown shallow areas where underwater props might go aground. The craft was converted to survey use from a sports boat called the Nordak II.

Brain surgery by computer

Electrodes aimed at the target area of brain tissue affected by Parkinson's disease are guided by a preprogrammed computer in a spectacular operation devised by Sweden's Dr. Lars Leksell

By STEVE HOPKINS





ON THE OPERATING TABLE lies a 64-year-old man, his head shaven, his face expressionless, his eyes turned toward the ceiling. Everything is set for the operation. He, a nurse and half a dozen visiting doctors await the arrival of the brain surgeon. The heavy silence is broken only by the juggling of the operating table caused by the uncontrollable shaking of the patient's right arm.

The shaking is not a sign of nervousness, but of Parkinson's disease. But it won't be long now, the patient knows, before his life will depend on the accuracy of an automatic machine. Once the machine takes over the operation, not even the surgeon can stop it or alter its course.

Parkinson's disease, thought incurable until recently, usually hits older people. Its symptoms are easily recognized: muscular rigidity and tremors, slurred speech, impaired locomotion and, in the late stages, almost a complete inability to control voluntary movements. Drinking a glass of water without spilling most of it becomes impossible.

Though the disease was first described almost 150 years ago by James Parkinson, its cause remains a mystery in many cases. Sometimes the condition results from a serious brain inflammation; sometimes from changes in the brain's blood vessels.

Parkinson himself noted that one of his cases underwent a self-healing process after a brain hemorrhage destroyed an area in the middle of the brain, and ever since then doctors have suspected that they could achieve the same result through surgery.

1. Using coordinate frame, surgeon knows exactly where to enter skull. Drilling is completely painless for fully conscious patient

2. Before operation, the victim of Parkinson's disease could not control his shaking arm. Drinking water from glass was impossible

3. Computer takes over, directing flow of current in electrodes. Ten seconds . . . 20 . . . 30 . . . 40. Suddenly man's arm stops shaking

MEDICAL

New techniques developed in recent decades make it possible for surgeons to work in the central regions of the brain. Following World War II, surgeons in several countries found that they could cure or relieve Parkinson's disease by the destruction of specific sites, located almost dead center in the brain.

Among these pioneers was Prof. Lars Leksell, chief of neurosurgery at the Karolinska Hospital in Stockholm, Sweden. It took him 15 years to develop a unique operating method that eliminates the need for eye control of instruments in this most delicate of operations.

Key to the operation is a set of X-rays, front and side views, which help the surgeon to pinpoint the exact target area. When the X-rays are taken the patient's head is held in a special frame with scales on it so that coordinates—like longitude and latitude marks on a map—can be used in reading the X-rays. After the brain target area and its size are determined, the information is transferred to a punch-card template which, in effect, controls the actual operation.

Ready for surgery

All this preparatory work has been completed for the patient, a cabinetmaker named Amandus Andersson, now awaiting the start of the touchy operation. For six years his muscle control has been so poor that work was impossible. Perhaps the operation will change all that.

Now, he hears the echo of Prof. Leksell's wooden-soled shoes in the hall. The 59-year-old doctor enters the room, his sterile hands held in front of him. The nurse helps him into his surgical gown.

The coordinate frame used in X-raying the brain is attached to the patient's head in exactly the same position as before. A local anesthetic deadens the area at the top of the head and an incision is made in the scalp, exposing the skull. With a hand drill, Dr. Leksell makes a hole in the bone slightly to the left of the middle of the cranium and opens the tough membrane enclosing the brain.

An electrode carrier is lined up with the hole in the skull. The operation has reached a critical point. Dr. Leksell makes a final check of all settings. Then he inserts two thin electrodes, each about



ALL IS READY AS THE BRAIN SURGEON makes final



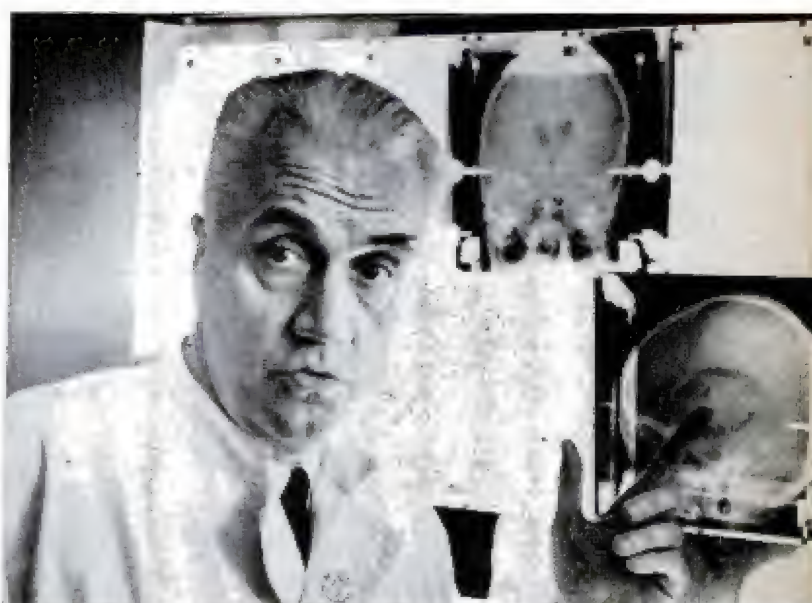
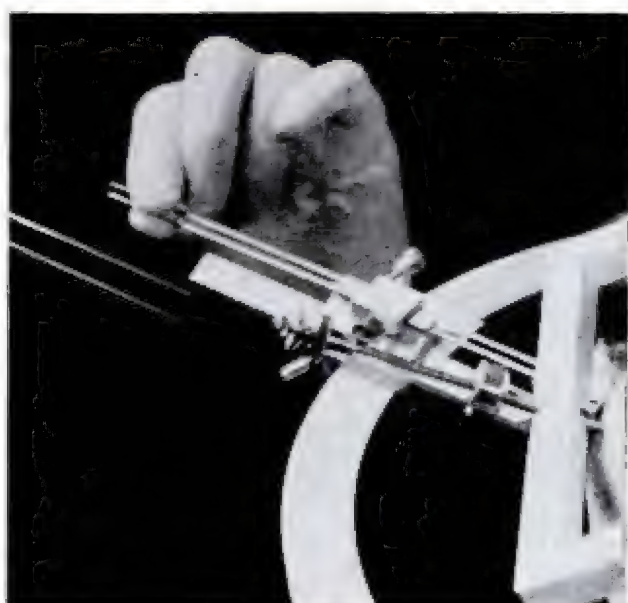
CRITICAL MOMENT APPROACHES when twin heat sensing elements are positioned for insertion into . . .

eight inches long, to the predetermined depth, burying half their length in the yielding brain tissue, which is insensitive to pain. Heat-sensing needles—miniature thermometers—in the electrodes will control the radio-frequency generator. With the punch-card template inserted at the top of the boxlike generator, the surgeon need only press a button with his foot and the operation will proceed automatically.

A green light flashes at the top of the generator. "Raise your right arm, please," the doctor tells the fully conscious patient. Andersson's shaking hand swings up. Dr. Leksell presses the button and electricity begins to pass between the points of the two electrodes, raising the



check of X-rays. The films are a precise map that he must follow with extreme care in making puncture



. . . electrodes already in brain. Once in place, their temperature signals to computer will determine how much current is used to blast diseased area. Dr. Lars Leksell (above) developed the unique operation

temperature of the nerve cells where the disease symptoms originate and destroying them. Ten seconds . . . 20 seconds . . . 30 . . . 40. The raised hand suddenly stops shaking. The template automatically shuts off the current.

"Clench your fist," the doctor says. Andersson closes his hand, opens it, closes it again. For the first time in six years it obeys him. Twenty minutes on the operating table, attended by one doctor, one nurse and an ingenious battery of equipment—and Amandus Andersson can return to a normal life.

Radio-frequency heating is an effective and commonly used means of destroying nerve cells in the brain. What's special

about the Leksell system is that the generator, once activated by the surgeon, takes orders only from the programmed template. Once set in operation, the system is its own master.

"This disturbed me psychologically in the beginning," says Dr. Leksell. "It takes some time for a surgeon to accept the notion that he must rely entirely on a machine. But he must if human error is to be eliminated. Once I've pressed the button, I can only wait, watch and pray."

In nine out of ten cases suitable for surgery, the operation leads to significant improvement or total recovery. Patients from all over the world are on Prof. Leksell's waiting list. ★★★



LONGER, LOWER, WIDER for 1967 is Plymouth's sporty and completely redesigned fastback

A Bolder Barracuda



TWO-DOOR HARDTOP styling, divided grille, large rear-window theme are continued this year

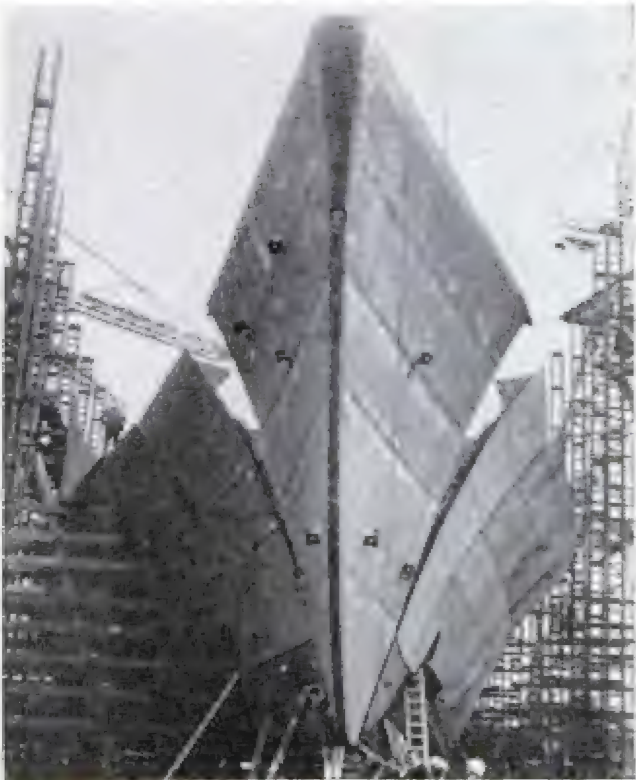


INNER BARRACUDA has undergone minor changes for '67. Bench seat and arm rest are standard, buckets optional

A LATE STARTER in Detroit's 1967 "sporty car" sweepstakes is this all-new Barracuda by Plymouth. Restyled from the ground up and unlike any other Plymouth, the new Barracuda can be ordered with a 383-cu.-in. V8, a power package that figures to make the car one of the industry's more potent compacts. Standard engine is a 225-cu.-in. Six or a 273-cu.-in. V8. A 273-4-bbl. is again optional, as is the Formula S handling package. Wheelbase is up 2 inches to 108; overall length is now 193 inches, 5 inches longer than the '66 model.



How tiny can they get? A new British television set with a two-inch-square screen was displayed at a recent show in London. The set, which operates on tiny batteries, will be in production by the end of the year, according to the inventor, Clive Sinclair. It receives both the BBC and ITV broadcasts in Britain.



Prefabricated bow, weighing 24 tons, went onto the *Spero* in one piece during the ferryboat's construction in England. The 8000-ton passenger and car ferry is now in service between England and Sweden, operated by Ellerman's Wilson Line.



Shoulder-fired tank killer that launches a guided missile and can be carried by a soldier is being developed for the Army by McDonnell Aircraft Corp. The missile has rocket motors around its body. As commands are sent electronically, these thrusters correct the missile's flight and guide it to the target.



A blind craftsman, using a jackknife as his principal tool, turns out perfect reproductions of antique furniture. He is Bill Jermyn of Whitby, Ont., who lost his sight five years ago. Jermyn first runs his hands over an original piece to get a mental picture of it, then sets to work with his knife and an occasional power tool.



Hovercraft are making an appearance in Vietnam as the Navy evaluates them in action against the Vietcong. Three of the British-built ground-effect machines have been operating from a base at the mouth of the Saigon River. Top photo: One of them approaches a native boat to inspect it. Below: Crewmen take aboard 50-cal. ammunition.



They're only dieting—not expecting a gas attack. Wearing masks to measure oxygen consumption, these two London University students are among 12 human guinea pigs in an experiment to determine whether 4800 calories per day is less fattening taken in two large meals or in 14 "nibbler" meals.



Stereo on a motorcycle yet! Californian Jim Muntz has mounted a stereo tape play-back unit plus a couple of tiny speakers on his motorcycle so he can listen to prerecorded cartridges while zooming through traffic. A 12-volt inverter doubles the cycle's voltage to operate the unit, a Muntz Stereo-Pak.



Hitting a bed of gravel at 80 mph, a supersonic Lightning jet fighter is stopped in three seconds in a simulated overshooting of a runway. The test took place at England's Farnborough research station, where the RAF is trying to find safe ways of bringing aircraft to a halt when they've overshoot on landing or aborted on takeoff. The pebble-filled pit is 400 feet long and 12 inches deep.



A Robin Hood touch in cattle branding is supplied by Scottish farmer John Randall, who shoots an arrow with a padded, paint-soaked tip at his animals to mark them for sale or slaughter. It doesn't hurt them, he says, and it's easier than marking by hand.



Pilots' body measurements are being taken now by the Navy to see which type of aircraft they're best suited to operate. Seven dimensions, standing and sitting, are recorded.

an expert's
for successful

BLUEPRINT INVENTING

Persistence, know-how and the knack for inventing the right thing for the right purpose can turn an invention into hard cash. The man who made a fortune doing it the right way outlines the secrets of his success.

By C. P. GILMORE



FINAL DEVELOPMENT MODEL of flexible-bladed washing-machine agitator was prototype for plastic device now part of Whirlpool washers

SEVEN VERSIONS of flexible-bladed washing machine agitator were built before Walton was satisfied device was perfect as he could make it

"MANY AMATEUR INVENTORS," says Bostonian Richard Rhodes Walton, one of the country's most successful professionals, "make three fatal mistakes."

- They try to invent the wrong things.
- They don't have the persistence to stay with a good idea until it pays off.
- They don't go about selling their inventions the right way.

Walton can speak with authority. He set up shop as a full-time independent inventor late in 1951. Today his inventions are raking in dollars, francs, yen, pesos and other assorted loot around the world. Although he's reluctant to talk about income, financial publications estimate that his annual take runs well into six figures.

To be successful, says Walton, an inventor must learn to handle three principal problems:

Problem No. 1. What to invent

"Most amateurs," says the ruddy-faced, white-haired inventor, "think primarily in terms of consumer products. But consumers are fickle. And the chances of inventing another zipper or ballpoint pen are slim."

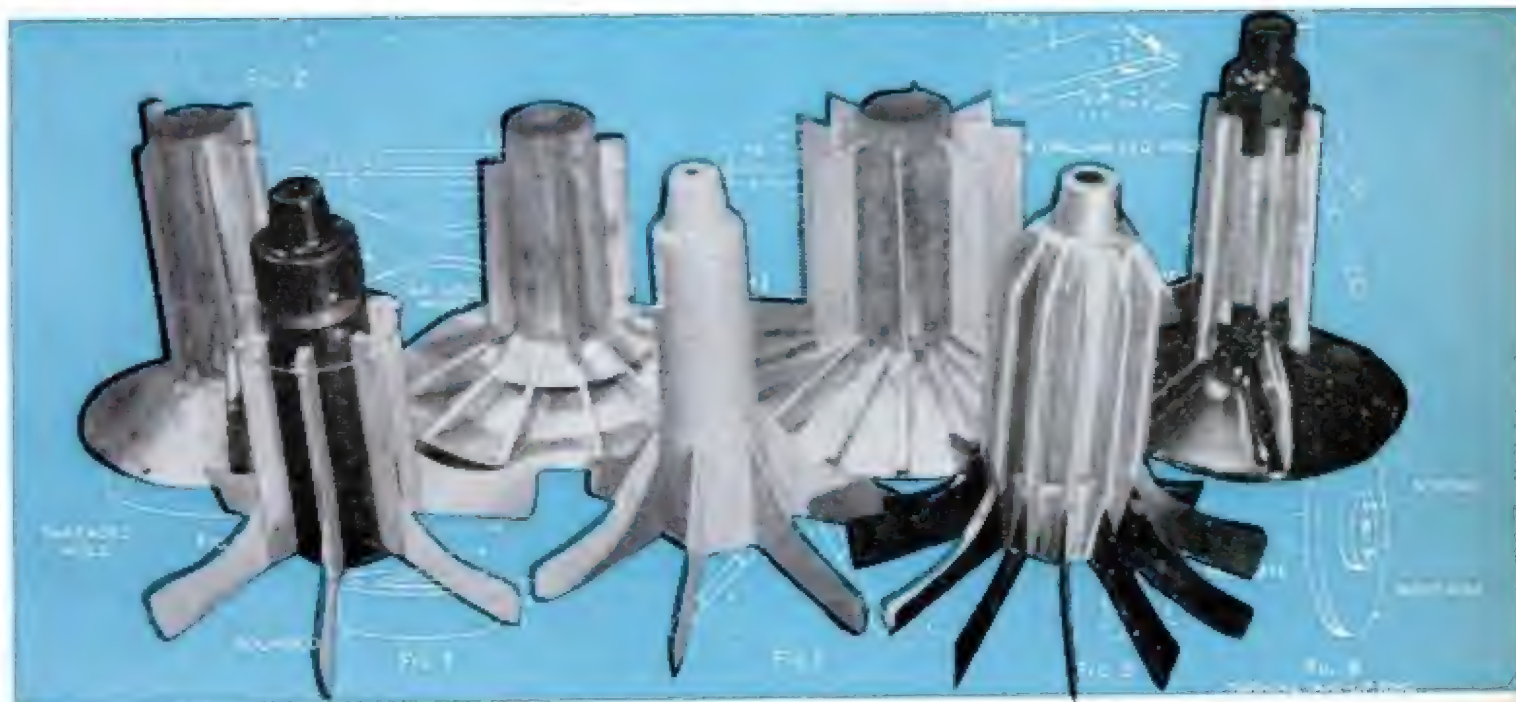
A more fertile field, says Walton—the one professionals concentrate on but amateurs rarely think of—is industrial machines and processes. "And a lot of the ideas needed," he adds in his soft, intense voice, "are the kind any inventor can tackle in his basement."

To illustrate, Walton led the way downstairs. There, among some \$25,000 worth of equipment — lathe, milling machine, precision grinder, metalcutting, bending, forming and punching machines — he pointed to Exhibit No. 1: a small machine in the center of the shop. Walton's assistant, master machinist George Munchbach, was making final adjustments.

"A few years ago," said Walton, "a friend offered to take me through three textile plants. The first thing I noticed was that three men were washing tons of fabric in a huge, automatic machine. Then it took 200 women to handle the output of the washer and feed the material to the next machine. I saw the same thing in the second plant. I didn't need to see the third. The bottleneck was obvious." In all the garment industry, Walton found, there was no machine that could pick up the top piece of cloth in a stack without disturbing the second one. The second, consequently, wouldn't be straight when its turn came.

"We knew the secret was in breaking that top piece loose," the inventor told me. He picked up an air hose an inch in diameter with an eight-inch plastic disc attached to its end. When he turned on a blower, a blast of air came from the center of the disc.

"Now watch," he said, lowering the disc over a stack of cloth pieces. A shallow



INVENTIONS

crater formed where the air stream hit. Ripples ran out to the edge of the stack. The top piece broke loose from the one beneath while both stayed perfectly in line. "The top piece is now lubricated by a layer of air," he said. "Grab one edge and pull it out." I tried, and it slipped out easily. The second cloth stayed put. I pulled out several more in quick succession. The top one slid away easily each time. Simple. Neat. Effective.

Industrial devices such as the cloth lifter, Walton explained, are good from the inventor's point of view for several reasons. They're easier to sell than consumer

items—and they're better money-makers. "Basic industries such as textiles and food aren't glamorous," he says, "but when you're dealing with a high-volume business, you need just a fraction of a cent rubbing off each pound or yard or gallon that goes through the machine."

Problem No. 2. Staying with it

It may be years, says Walton, before a basically good idea begins to affect the inventor's bank account favorably. Back in the early 1950s, for example, Walton heard that no one had ever found a way to shrinkproof cotton knit goods. At the time, Walton was working on a machine to make crepe paper. (To most people,



crepe paper is the brightly colored decorative material used on festive occasions. Actually, creping is a process of treating paper to make it stretchy, soft and absorbent. Paper toweling is crepe paper, as are facial tissues, and toilet paper. Despite the fantastic volume of paper creped each year, the process was still messy, wasteful and expensive.

Walton's very simple machine could do essentially the same thing by crushing the paper in on itself between two rollers. A piece of paper that went into the machine 20 inches long, for example, might come out half that length, but soft and fluffy.

When the inventor heard about the shrinkproofing problem, he was hit by a sudden thought. His creping machine was, in effect, mechanically shrinking paper. Maybe it could preshrink knit goods.

One Sunday afternoon in 1953, Walton went to his basement workshop and put together a gadget that looks much like an old-fashioned clothes wringer. One roller was rubber; the other, sandpaper. The rubber roller was geared to turn slightly faster than the other. When the knitted fabric was fed by a metal shoe into the space where the two rollers met, the rubber one tried to force it through quickly, while the sandpaper roller, turning more slowly, tended to hold it back. The cloth came out preshrunk.

Despite his early success, it was three years before Walton decided he had a model good enough to show. He took it to the William Carter Co., a nearby knit-goods firm, for a trial. Carter, impressed, called in Tubular Textile Machinery Co. to develop a high-speed, continuous-duty production machine. Tubular Textile spent four years at it, then Carter and Tubular tested and debugged the prototype another two years. Finally, after nine years, the machine hit the market.

Today, more than a score of plants use the Walton process. The *Wall Street Journal* estimates that the device may now bring the inventor \$150,000 a year in royalties. But it didn't happen overnight.

Problem No. 3. Selling it

As to tips on markets for inventions, Walton says "a machine that just demonstrates an idea isn't good enough to show." (A company turned down a small portable washer Walton once offered because the

[\(Please turn to page 202\)](#)



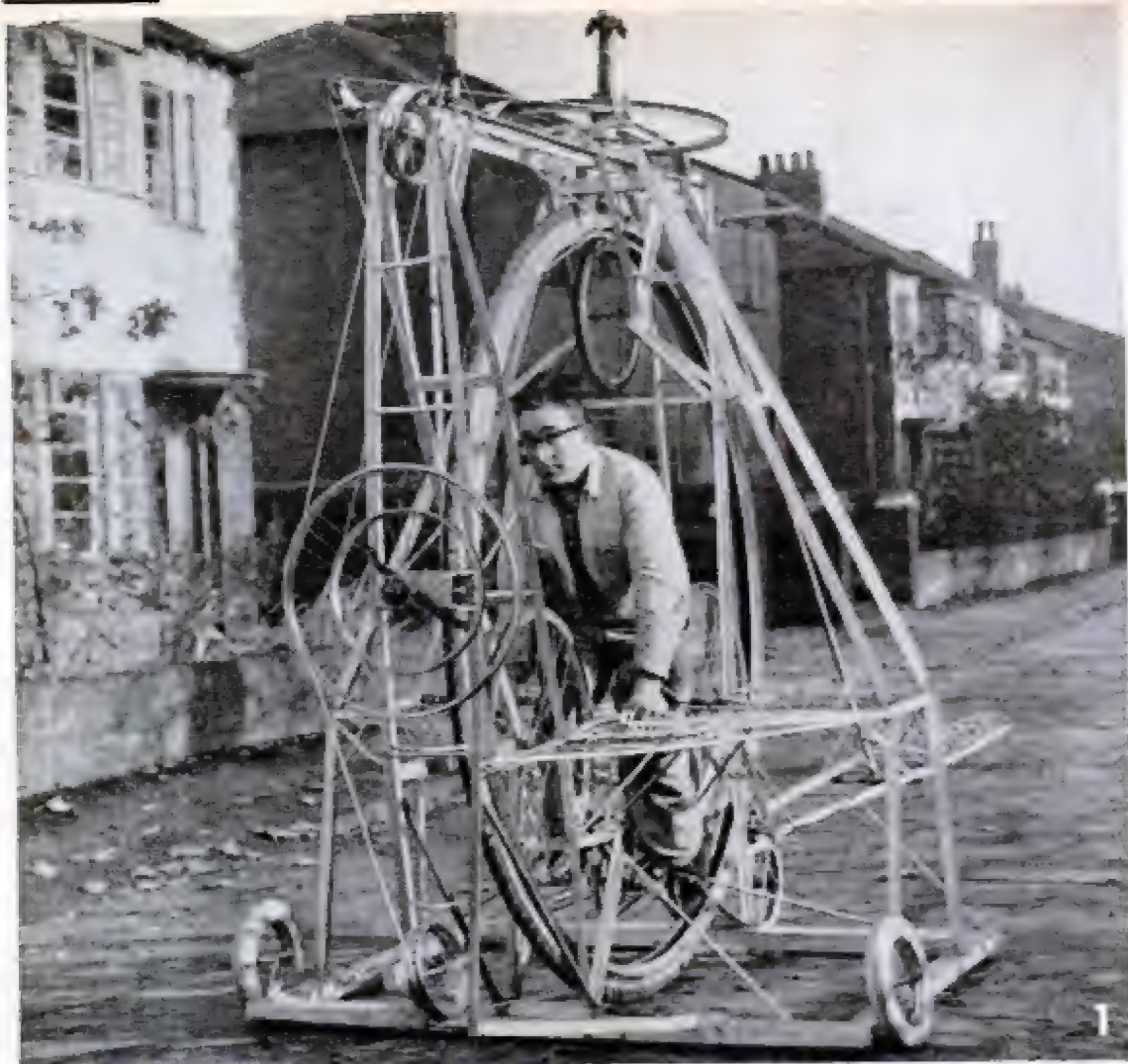
INVENTOR WALTON operates the first successful model of his cloth-lifting machine, and his assistant, George Munchbach, holds the first sample model



MANY VERSIONS of Walton's portable washing machine were built and tested before the first successful model (right) reached the appliance market



CLOTH-LIFTING MACHINE is now used in a laundry for folding towels; other versions are being developed to handle cloth during garment manufacture



BRITISH SKYBIKERS TAKE TO THE AIR...



(more or less)

equally as successful, have announced, "The Wright Brothers were wrong." So far, however, none of the wing flappers have been right. The Whizzers include John Davies, a Sussex schoolmaster, who sits on a light metal framework and pedals furiously to drive a four-bladed overhead rotor, a somewhat drafty business. There is, unfortunately, no record of movement, upward or forward.

Warrant Officer Spencer Bailey of the Royal Air Force hopes to succeed with his Cyclopter—a two-bladed, two-pilot contraption—presuming, of course, that the added power will offset the added weight.

Bob Wilson, a cycle repairer, built a gyrobike with 13 wheels and 40 gears but, after five hours of effort one day, pooped out and gave up. Graham Rouse, a Southampton engineer, has designed a more conventional looking gyrobike with conventional success: none. The Whizzers are next, and they seem to be getting somewhere—not far, but somewhere. Several have actually left the ground. Southampton University's was the first. In Nov. 1961, its 80-foot span and 130-pound frame, powered by a furiously pedaling student, flew more than 400 yards without mishap.

In 1962 near Hatfield, John Wimpenny, a jet designer, broke the record in another model with a flight of 993 yards at a speed of 19½ mph—after training six months.

"I biked to work every day, five miles each way," he explained, "but the secret is liver. I eat loads of it. Jolly good for the muscles."

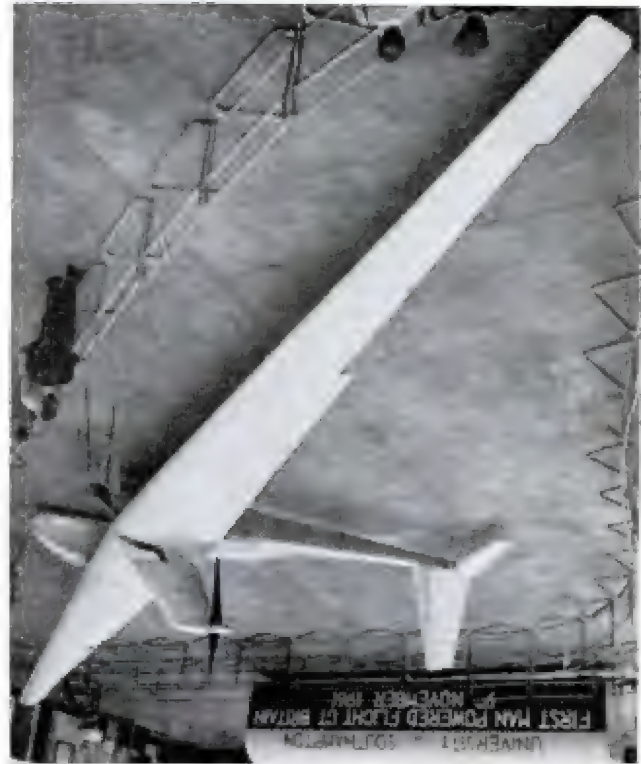
"I detest the stuff," Wimpenny's craft is called Puffin because of the amount of breath needed, especially for takeoff. It requires as much as for the rest of the entire flight.

A man in training can produce 1½ hp in a minute or ½ hp for an hour or so. The Puffin needs nearly 1 hp for the takeoff and ½ hp to keep it going, and the power requirement increases for turns, which accounts for most of the flights to date being straight ahead.

Wimpenny admits, "I could have kept going straight for ages, but when I started thinking about my turn, my pedaling lapsed, and I had to come down."

There doesn't seem to be any doubt, however, that the Whizzers—the exponents of the fixed wing and conventional prop—are leading the field for the £5000 prize. Most are trying one pilot, but others, two. One group has a professional pilot and an Olympic cyclist pedaling side

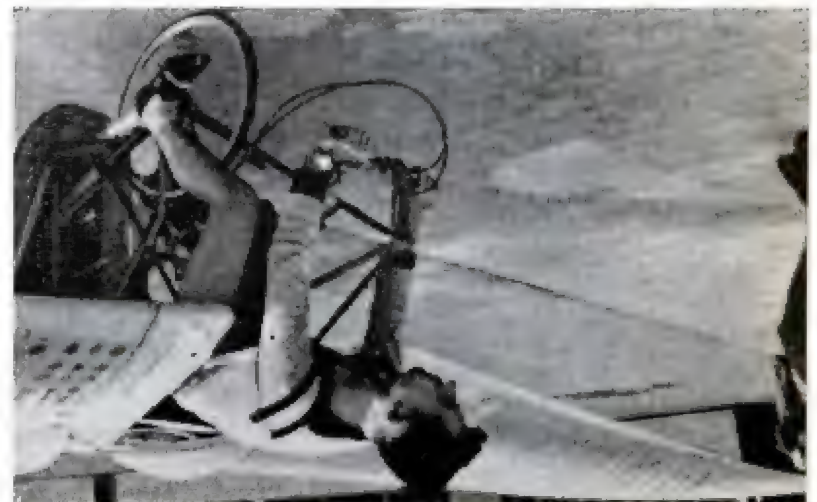
by a group at the University of Southampton. It lasted 400 yards and encouraged other groups



INTREPID PILOT, with intrepid wife and daughter steadying the wings, rose a few inches off the runway with this homebuilt, but quickly returned again



MOST PILOTS lean forward in cockpit in bicycle-riding position. Some flights have been made, however, with pilot lying flat on his back to pedal



Setting aviation back at least 63 years, and perhaps 5000, some daring young men are trying to fly with their muscles, just like the birds

By JAMES A. MAXTONE GRAHAM

THERE ARE FLAPPERS and Whirlers and Whizzers, and they are spread all over the world. They are trying, literally, to rise to the occasion, to get their feet off the ground. They want to succeed where Icarus and da Vinci failed. They want to fly using their own muscle power.

They design Skybikes, Cyclopters, Helipedes, Skycycles, Orthopters and Aerostats. Most of them have never left the ground, and those that have—well, they haven't gone far. But anyone who does succeed in flying one in a figure-eight pattern over a mile course at least 10 feet off the ground—and lives in the British Commonwealth—will win a £5000 prize (about \$14,000).

So they keep trying; and the first are the Flappers, the imitators of nature. "Birds and bees do it," they reason. "Why can't we?" They design slavish imitations of the wings of hawks or seagulls or pigeons, forgetting that wings of birds have several times the relative power of anything man can produce and that, in nature, the larger the bird the less likely it is to fly. The largest flying bird weighed only 35 pounds.

But, in Devonshire, a hardy youth named Mick Walton raced down a hill with a set of 100-pound wings strapped to his shoulder. Later, surveying the wreck-age, he panted manfully, "Failure is but the beginning of success." Others,

1. Perhaps the gaudiest of the gyrobes, this Rube Goldberg contraption has 13 wheels and more than 40 gears, none of which helped it off the ground. Designer is trying to win £5000 prize.
 2. Another semifaure, fixed-wing plane crashed after 50-yard flight on muscle power alone. Prize will go to first man-powered aircraft built in British Commonwealth to fly a one-mile figure-8 course.
 3. So far, longest flight was made by Puffin; a total of more than half a mile straight ahead. No one has yet made any appreciable turns in manpowered craft because of added power needed.

3

by side, to get the benefits from both talents. Others are thinking of two in tandem, with the man behind pedaling with both feet and hands. One scientist suggested a crew of eight with cox.

Position of the pilot also has its variations. The pilot of Southampton University's craft lay flat on his back. Most observers feel this impairs vision. Generally, the pilots ride bicycle fashion, leaning forward over the handlebars, although some are still toying with a 45° reclining position.

Anyone could build one of these craft, although if they lived outside the commonwealth, they would not be eligible for the prize. All it takes is about \$600, an unlimited time for work and a thorough knowledge of aeronautics. The Hatfield group had the best advantage, with the de Havilland Aircraft Co. offering the use

of its computers to work out the ideal structure, size and shape of the wings, and so on, as well as some of the materials.

But the basic idea is intriguing enough for some bright chap, regardless of reward, to try. Just think of it. Ride a plane into the sky just like a bicycle. No engine, no gasoline, no tow plane, nothing. Just manpower.

Perhaps a wing-flapper will get his craft to work with the power of birds, or perhaps a helicopter type will overcome inherent control problems, or, more likely, perhaps a fixed-wing craft will get up and make turns as it should.

Remember, it was a prize such as this that prompted Lindbergh's flight. ★ ★ ★

CONVENTIONAL GYROBIKE, like the others, still hasn't got off the ground, and observers feel it would have control problems even if it did. Wing flappers have had even less success. But experimenters continue trying to fly like the birds

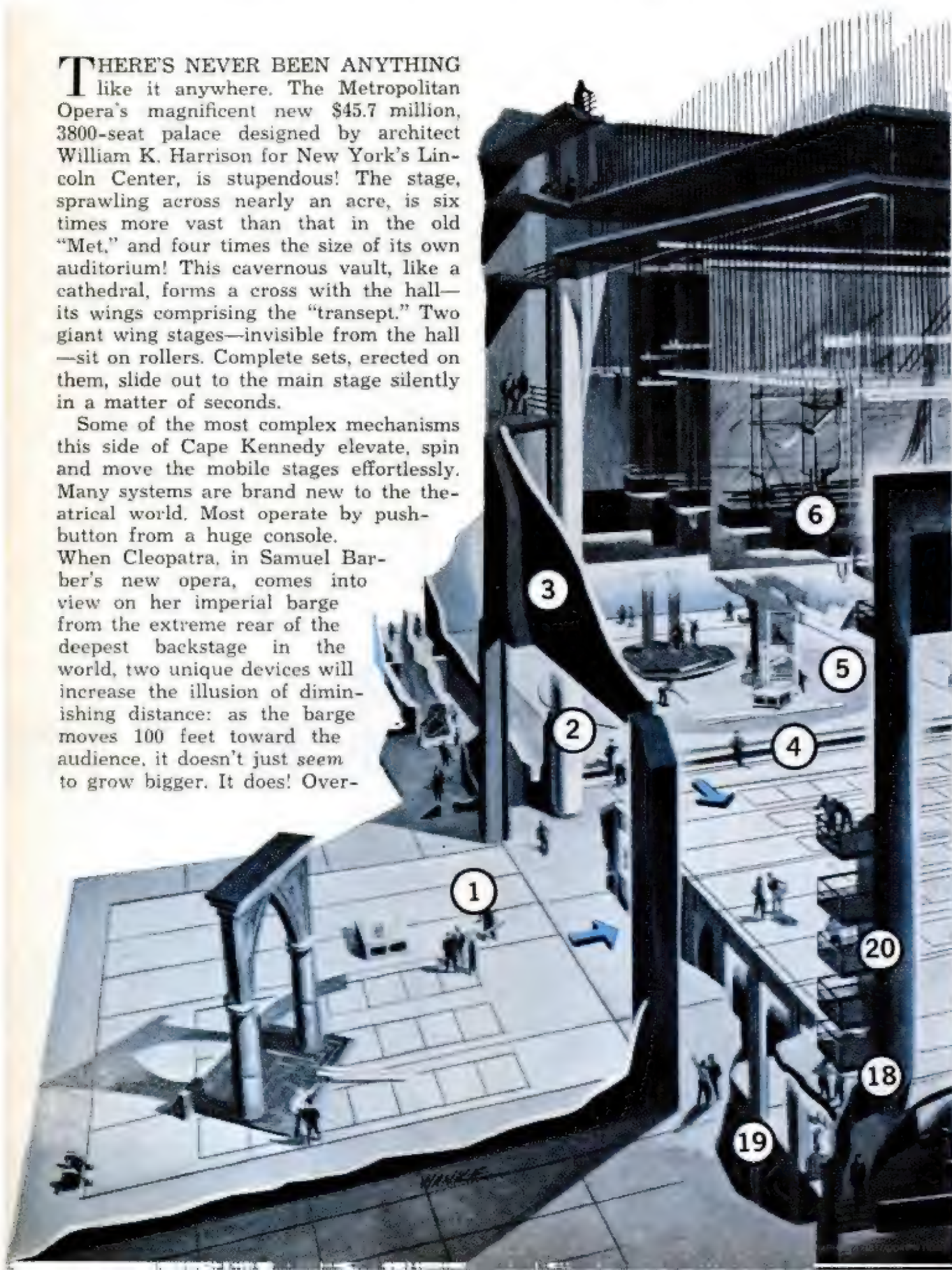


The giant stage that

New York's spectacular new "Met" boasts four stages, three on wheels,

THERE'S NEVER BEEN ANYTHING like it anywhere. The Metropolitan Opera's magnificent new \$45.7 million, 3800-seat palace designed by architect William K. Harrison for New York's Lincoln Center, is stupendous! The stage, sprawling across nearly an acre, is six times more vast than that in the old "Met," and four times the size of its own auditorium! This cavernous vault, like a cathedral, forms a cross with the hall—its wings comprising the "transept." Two giant wing stages—invisible from the hall—sit on rollers. Complete sets, erected on them, slide out to the main stage silently in a matter of seconds.

Some of the most complex mechanisms this side of Cape Kennedy elevate, spin and move the mobile stages effortlessly. Many systems are brand new to the theatrical world. Most operate by push-button from a huge console. When Cleopatra, in Samuel Barber's new opera, comes into view on her imperial barge from the extreme rear of the deepest backstage in the world, two unique devices will increase the illusion of diminishing distance: as the barge moves 100 feet toward the audience, it doesn't just *seem* to grow bigger. It does! Over-

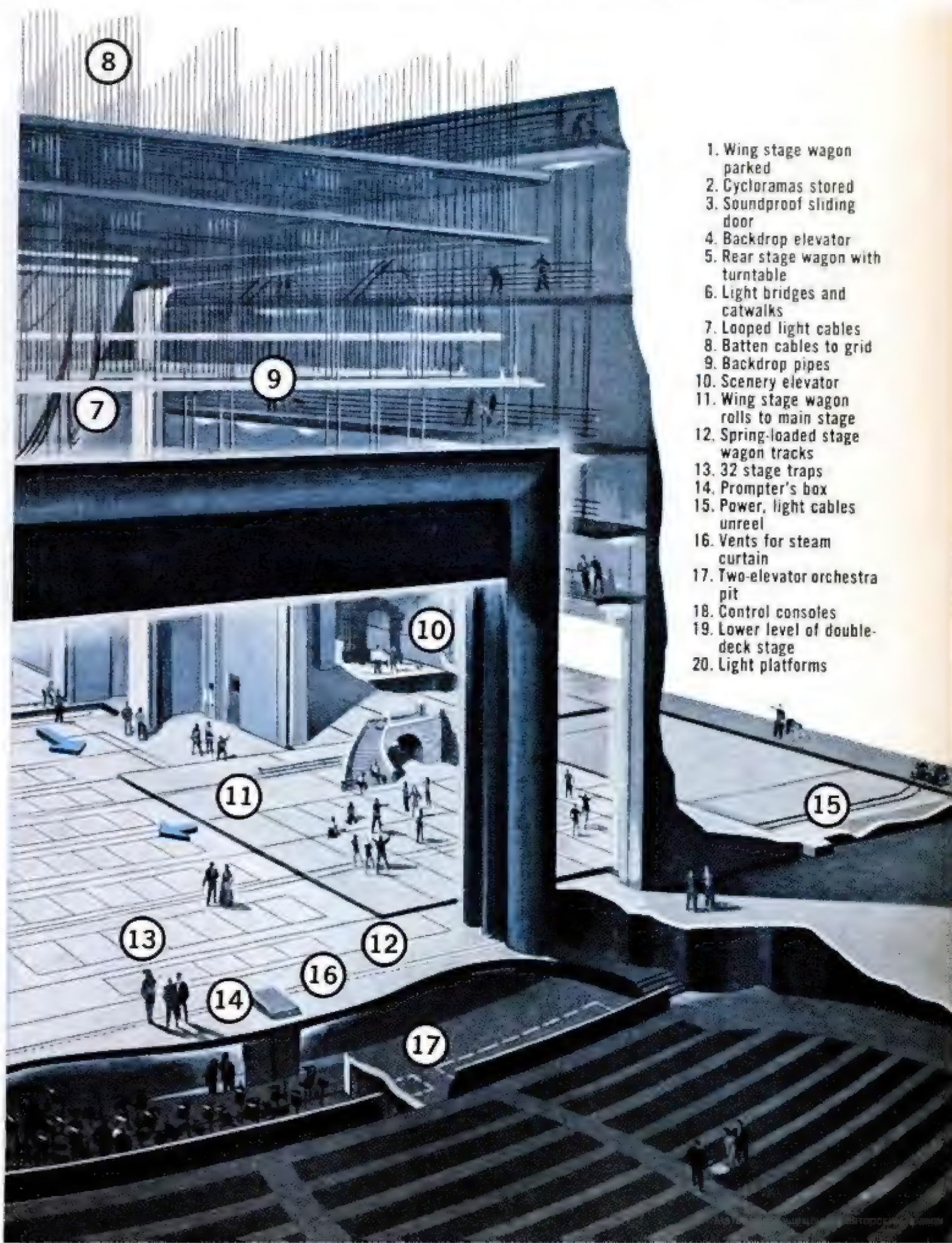


shifts for itself

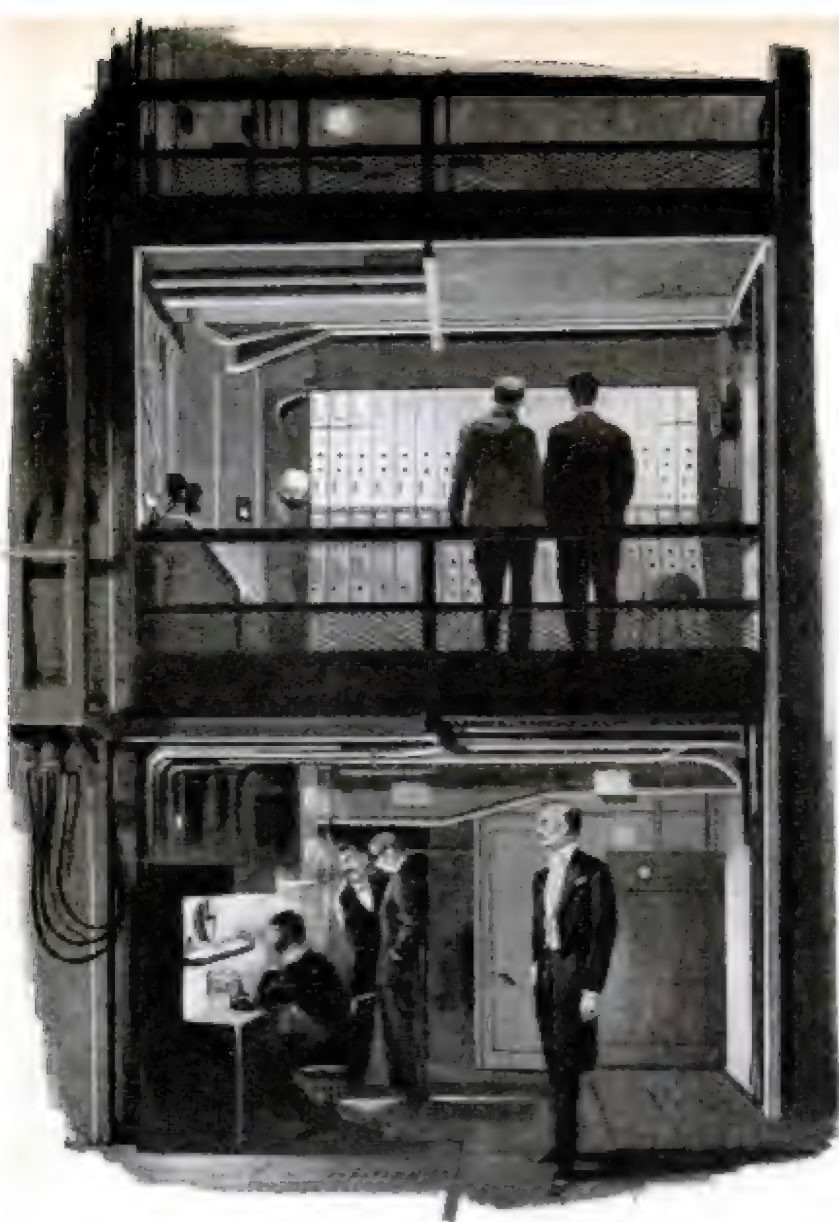
By CREIGHTON PEET

Illustrations by Ted Hanke

and scenery that appears and disappears before 3800 opera fans



1. Wing stage wagon parked
2. Cycloramas stored
3. Soundproof sliding door
4. Backdrop elevator
5. Rear stage wagon with turntable
6. Light bridges and catwalks
7. Looped light cables
8. Batten cables to grid
9. Backdrop pipes
10. Scenery elevator
11. Wing stage wagon rolls to main stage
12. Spring-loaded stage wagon tracks
13. 32 stage traps
14. Prompter's box
15. Power, light cables unreeled
16. Vents for steam curtain
17. Two-elevator orchestra pit
18. Control consoles
19. Lower level of double-deck stage
20. Light platforms



AT CONTROL CONSOLES on tower platforms left of proscenium arch, scenery is changed, stages whirl or disappear at touch of buttons

lapping sections of the hull slowly expand . . . and Cleo, standing on a hidden elevator in the barge, levitates several inches so that she, too, looks bigger as she gets nearer.

Seven elevators make up nearly the entire floor of the main stage, enabling people as well as scenery to appear and disappear right before the eyes of spectators. For the first act of *Traviata*, for instance, two of these lifts are lowered seven feet. From the resulting "hole," brilliantly attired guests walk up an ornate grand staircase to Violetta's dazzling ballroom, appearing to come from a lower floor. The ballroom has been set up previously on one of the mobile wing platforms and rolled to stage center for this act.

Though no single opera can possibly utilize all the mechanical magic of the Met, *Traviata* comes close. As the curtain falls on act I, stagehands at the electronic

control center—one level above the deck in the right wings—start pushing buttons. The two depressed elevators quietly rise to stage level. Violetta's ballroom glides away into the south wing, while her luxurious country manor with its gardens rolls in from the other side.

A technician at the six-foot-long console controlling the "pipes," from which backdrops are hung, pushes a lever. The ballroom walls, ceiling and chandelier disappear into the 10-story overhead. As they rise, trees, bushes, stone walls, vines and lawns descend from the heavens to complete the country estate vistas. And it all transpires in less than 60 seconds!

That's only the beginning. A 58-foot revolving platform built into the mobile rear stage may carry a grand staircase rising out of sight—until the platform revolves to disclose a waterfall and fountain for a garden scene. Occasionally, the "revolver"



TOWERING ARCHES of the Metropolitan Opera's new house, designed for New York's Lincoln Center by W. K. Harrison, march majestically across fountain plaza. Behind them lies the world's most automated theater

will rotate while the stage on which it is mounted is rolling forward. Many changes will be in full view of the audience.

While movies and television reduce theater to shadows on a screen, and Broadway staging often is impressionistic, grand opera still insists on realism. The ship in *Gioconda* may be made of lumber braced with steel, canvas, plastic and foam rubber. But its hull, deck, masts and sails appear absolutely real. So do the walls of Peking in *Turandot*, the duke's palace in *Rigoletto* and the spectacular underwater scenes in the Ring operas.

When you see the machinery that helps produce this realism, your head swims. The three extra stages surrounding the center stage are actually giant motorized platforms: 60 by 40, 60 by 48 and 60 by 60 feet respectively. Each of these "stage wagons" is powered by four 5-hp motors driving 8-inch polyethylene wheels.

In addition, 100 wooden idler wheels support each wagon and keep it level. The drive wheels run on wooden rails that are mounted on heavy springs, so that normally they are flush with the floor. When the 1200-pound weight of a stage wagon presses on them, the rails depress about an inch, forming a steel-bound guide slot. Each wagon trails two power cables that unwind from reels.

Suppose the vast hall of the Egyptian palace in *Aida* has been set up on a stage wagon and moved into position. Naturally, it is a foot higher than the surrounding stage area. This is quickly remedied. More buttons are pushed and the seven elevators making up the main stage lock together and descend one foot. Everything is flush. When the scene ends, the elevators rise and the palace rolls away.

Changing a stage wagon set is noisy and

(Please turn to page 204)



Deathwatch beetles, which are death on old English homes and churches, are lured from their hiding places in woodwork by a unique combination of science and modern technology. The beetles' mating taps, duplicated by rattling a glass rod in a test tube (top left), are amplified and played over loudspeakers (top right). The beetles, which burrow into the woodwork and hibernate until mating season, come crawling out (right) and are swept up (left).



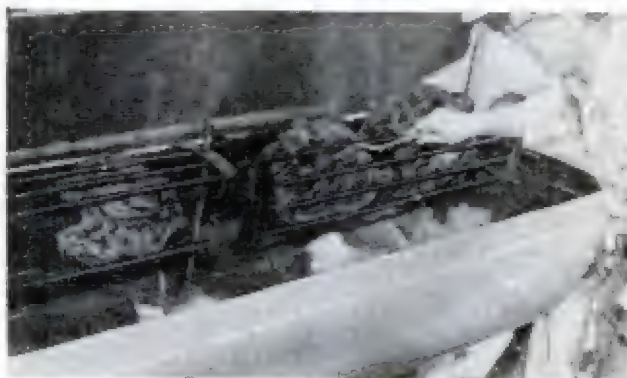
A twin-rotor helicopter, seating two, may sell for less than \$20,000. The tandem rigid rotors give the Beta 200 a stable platform, and a 210-hp engine, which powers both of them, produces speeds up to 150 mph. If the price holds, it will put the Beta in the medium-price light airplane range. Production is scheduled to begin in 1967.



Motorized skates, the result of 25 years of research, are the invention of a 56-year-old plumber, Albert Nicholas. Using .85-hp gas engines on each skate—he made the skates—Nicholas can reach top speeds of 50 mph. The engines are started by pulling a rope and are operated, through a centrifugal clutch, by squeezing a hand control. Nicholas foresees their use as racing skates—too dangerous for general use.



Caterpillar dumper was developed for carrying 30-ton loads over rough ground or ground with soft subsoils. Fully loaded, it can travel more than 50 mph. Made in West Germany, it uses an aluminum dumper which reduces maintenance and lightens the empty weight. The tracks ride on five pairs of main wheels, with two pairs of sprocket wheels at either end.



Oven broiler, made from an old 300-gallon water tank split in two, bakes and barbecues at Boy Scout camps and other large outings. Capable of cooking 200 pounds of meat at one time, the unit includes spits rotated by bicycle chains and powered by an electric motor. The broiler rides on an I-beam and can be trailed behind an automobile for out-of-town camps.


LOOK WHAT THEY'RE DOING WITH...

MAGNETS

By HARLAND MANCHESTER

Illustration by Gil Evans

Powerful chunks of "tug" are beating cake batter, holding false eyes in place, aiming electronic bullets in atom smashers and performing an avalanche of new "impossible" jobs.



PULSATING WARNING turns to shrill alert in earphones and rescuer knows he's on target. Field of magnet attached to avalanche victim's shoe has been picked up by electronic detector on pole.



WHIRLING MAGNET IN BASE is so strong it easily spins mixing blade in glass of water inches above it. New type mixer has many different kitchen uses



NO POLE NEEDED. Slim ceramic magnets in top of hanger cling to steel plate above. The setup permits more flexible use of space in a small closet

A SKI PATROL RESCUE TEAM tramped over a snow-clad California slope a few winters ago, armed with a strange device. The leader carried a long pole which he waved back and forth as he walked. At its tip was an electronic detection device, and through earphones he could hear its pulsating hum. Seven minutes after his search began, the signal suddenly became shrill and insistent.

"Dig here," he said. Ten feet down they found a skier, one of two who had been buried alive by a snowslide. Three minutes later they found his friend. Both survived the ordeal without serious harm. Each man was located by means of a cigar-shaped magnet attached to one of his ski boots, which radiated a magnetic field so powerful that it alerted the sensitive detector. The device on the pole was a specially designed magnetometer, such as is used by prospectors to locate mineral deposits; it measures minute variations in the earth's magnetic field.

These "victims" were volunteers and their "rescue" was a test, but snow burial has been a grim ordeal for hundreds of real avalanche victims in the world's winter resorts in recent years. Many have died before they were found.

Other search methods involve poking sticks through the snow, which may injure the trapped skiers, or using dogs, which are of little value after their feet are caked with snow. The magnetic method, developed by Varian Associates of Palo Alto, Calif., has been tested successfully by the Swiss army and was a part

of the equipment of the American Mount Everest Expedition in 1963.

This is one of a thousand new uses made possible by modern improvements in the age-old magnet. The horseshoe carbon-steel type is now virtually obsolete, its place taken by powerful lilliputian magnets made of new alloys and ceramic magnets baked from assorted "doughs." They come in all shapes—pellets, discs, rings and strips—and are so cheap that their use is limited only by man's imagination.

Ever since refrigerators were invented, small children have been locking themselves up in abandoned iceboxes, often with fatal results. For decades, no one seemed to know what to do about it, but all refrigerator doors now manufactured can be pushed open from inside with a force of only a few pounds. The solution is a magnetic gasket. A batch of rubber containing powdered metal is baked in strips and then magnetized. Cemented to the door edge, the flexible magnet forms a tight union with the metal box. The magnetic attraction lasts as long as the refrigerator and, as a bonus, there is no mechanical latch to get out of order.

Most new kitchen cabinets and closet doors now have magnetic attaches which the housewife can close securely with a slight push when her hands are full. She may hang her shopping list on a magnetic bulletin board and her kitchen knives on a magnetic rack. When she opens a can, a magnet picks off the top.

Twenty years ago you could number the applications of permanent magnets on



FLY ACT WITH MAGNETIC SHOES. Though magnets are the permanent type, they can be "turned off" with burst of electrical current, permitting foot to move



FRICTIONLESS TRAIN OF FUTURE? Magnets in rails and bottom of cart repel each other, causing vehicle to "float" above track. Mere finger push moves it

POPULAR MECHANICS

your fingers and toes. Now manufacturers list 250 applications, and each may cover a dozen or more individual uses. At the Marengo, Ill., plant of the Arnold Engineering Co., one of the world's biggest magnet manufacturers, you see devices ranging from powerful aids to science and industry to ingenious small gadgets for consumers.

The company's largest magnet assembly looks like an open metal barrel and weighs half a ton. The barrels, built for Stanford University's new giant atom-smasher, are spaced along a small straight pipe two miles long to focus a stream of speeding electronic "bullets." When in full operation, the machine will be used to smash particles in an attempt to find new answers to the old question: what's inside the atom? The pull of the barrel magnets is so strong that they yank heavy tools from unwary workmen.

Other magnets are used to concentrate on low-grade taconite in Minnesota mines. Mounted inside revolving drums partially

submerged in a slurry of ore, they pull out lumps of iron while dirt and impurities are washed away.

"Hardware disease," long a problem of the dairy farmer, is relieved by a magnet of special design. Cows are greedy feeders and swallow metallic debris like fence staples and bits of baling wire along with pasture grass or silage, often with fatal results. "Cow magnets"—smooth cylinders about the size of a man's thumb—are slipped down the gullets of entire herds. They remain in the second stomach (cows have two) for life, trapping bits of metal which otherwise would pass on and do damage.

The modern age of magnets began in 1931 when Y. Mishima, a Japanese scientist, brought forth the alnico magnet, which contains aluminum, nickel and cobalt. Developed and improved by the Philips Research Laboratories in the Netherlands, the General Electric Co. and others, the little alnico will do a job that

(Please turn to page 192)



HELD AT END OF "BALLING GUN," magnet goes down cow's throat as easy as any pill. Veterinarians normally use instrument in giving capsulated drugs



CYLINDRICAL MAGNET lies in animal's second stomach, "grabs" hardware bits. Lower magnet shown was taken from cow's stomach after 11-month period

DECEMBER 1966

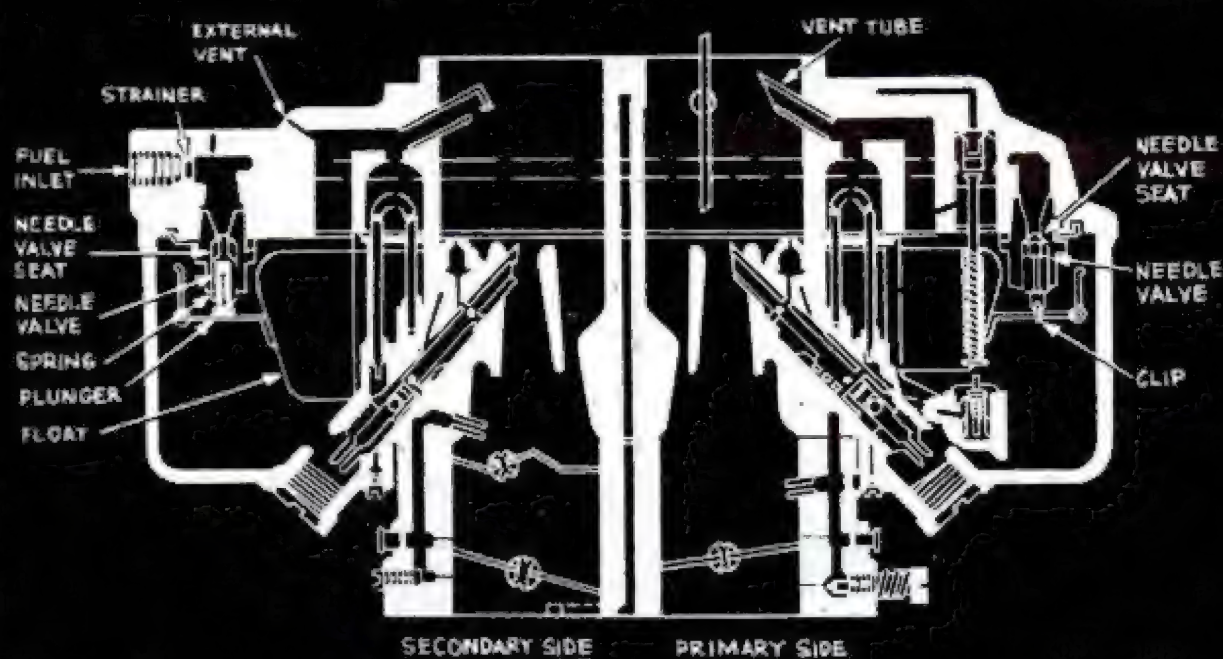


IF NAILS, STAPLES AND OTHER DEBRIS in feed are not caught in stomach, they can cause severe injury. At slaughter, this collection was removed from bull

the abcs of carburetion

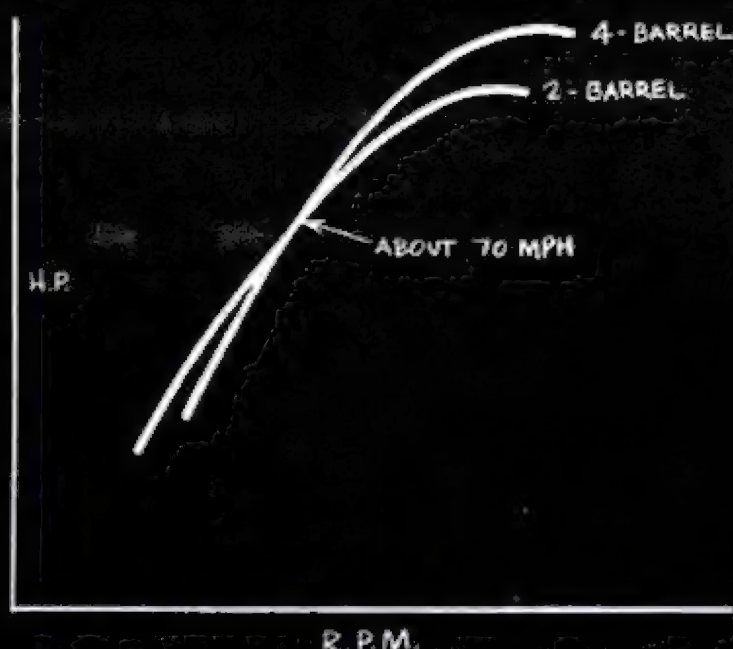
the modern automotive carburetor is a mechanical marvel combining engine efficiency over a wide power range with miserly fuel consumption.

By Roger Huntington, ASAE



OFFSET BUTTERFLY VALVE (upper right) in 4-bbl. carburetor keeps rear barrels shut 'til needed

CARBURETOR CAPACITY affects both ends of power curve. A 4-bbl. carb improves breathing at top, but may prove sluggish in throttle response at low speeds



IN ANY "INTERNAL COMBUSTION" ENGINE, such as those used to power cars, trucks and boats, liquid fuel must be mixed with a certain amount of air to form a combustible mixture that will burn in the engine's cylinders.

One way to mix air and fuel is to let the cylinders draw in raw air on the suction stroke, then squirt the fuel either into an intake port or—through a nozzle—directly into the cylinder. This is done in a diesel engine, a fuel-injection car or a racing engine.

A simpler and cheaper way is to use a carburetor—nothing more than a device to meter a precise amount of fuel with a certain amount of air. A gasoline engine will only burn air/fuel mixtures between 12-15 parts air to one part fuel (by weight), so the carburetor has to meter the mixture accurately. The carburetor is mounted outside the engine and the air/fuel mixture is carried by engine suction to the cylinders through "manifold" passages. Carburetors have been doing the job for over 60 years.

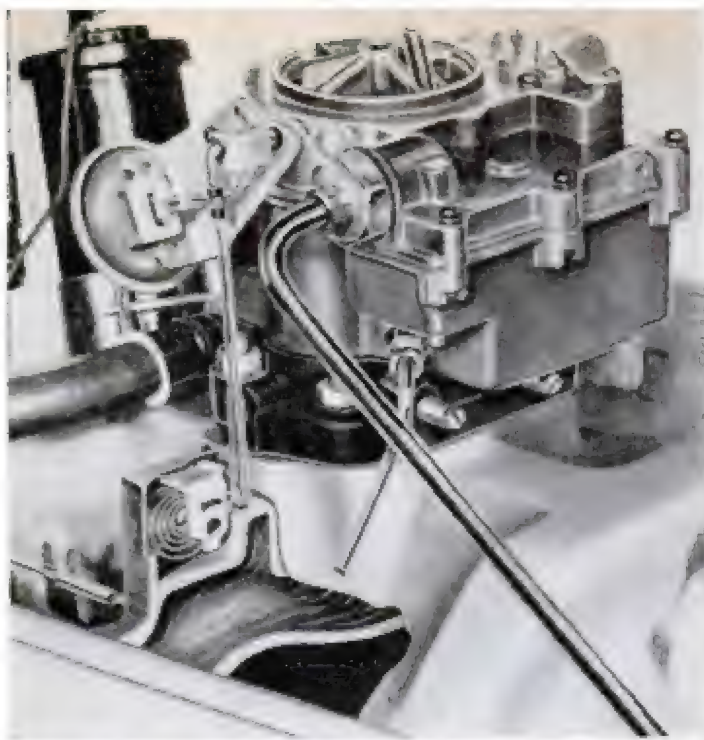
A modern automotive carburetor, however, has a very complex job. It has to meter the fuel and air over a wide range of engine speeds and loads with a minimum of "breathing" restriction to the air flowing into the engine (restricted "breathing" reduces power). It must meter a "lean" mixture for cruising, a "richer" mixture for maximum power and for idling. It must incorporate some sort of automatic choke that will give a very rich mixture for starting the engine cold, but the choke must shut off automatically when the engine warms up. It must give a momentary squirt of extra fuel when you punch the throttle to pass somebody; otherwise the engine would cough and stumble. And, of course, any commercial automotive carburetor

AUTOMOTIVE

must be as simple, inexpensive and reliable as possible. It's a big order.

The earliest cars had unbelievably crude carburetors. Fuel was metered through a needle valve into an air tube leading to the cylinders and was fed from a tank above the carburetor. It flowed by gravity into a float bowl that acted as a reservoir for the needle valve. There wasn't even a "venturi" throat in the air tube to give a suction force to draw the fuel. It just dribbled in. The mixture was adjusted manually by turning the needle valve. Carburetion was "right" when the engine would run! Simple, if nothing else.

Modern carburetors for small gasoline engines—outboard motors, lawnmowers and chain saws—aren't much more complicated. They generally use float bowls and venturis for suction metering. But the basic air/fuel mixture is adjusted by a needle valve. Sometimes there are two discharge holes in the air passage—one below the throttle butterfly (when it's closed), the other uncovered by the butterfly as it is opened wider and engine speed increased. The primary hole, fitted



THERMOSTAT CONTROLS automatic choke, "senses" manifold heat, shuts choke off when engine warms up

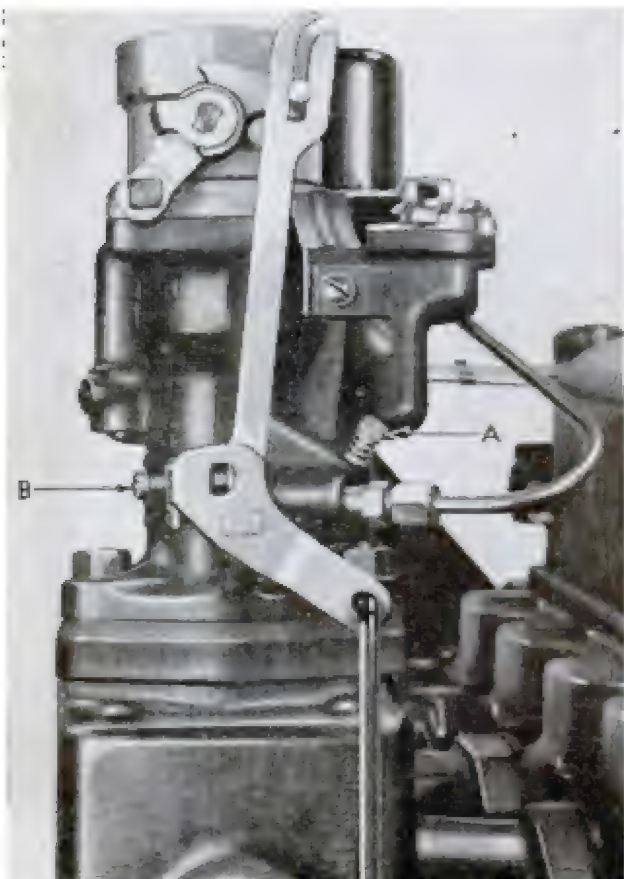
with the needle valve, controls idle and low speed; the secondary hole has a fixed jet, or orifice, calibrated to meter a certain air/fuel ratio.

Engines that have to operate in different positions (e.g., a chain saw) dispense with the gravity-fed float bowl and spray the fuel into the cylinder(s) under pressure from a vacuum-operated fuel pump. A venturi is used to get a suction "signal" to control a fuel metering valve.

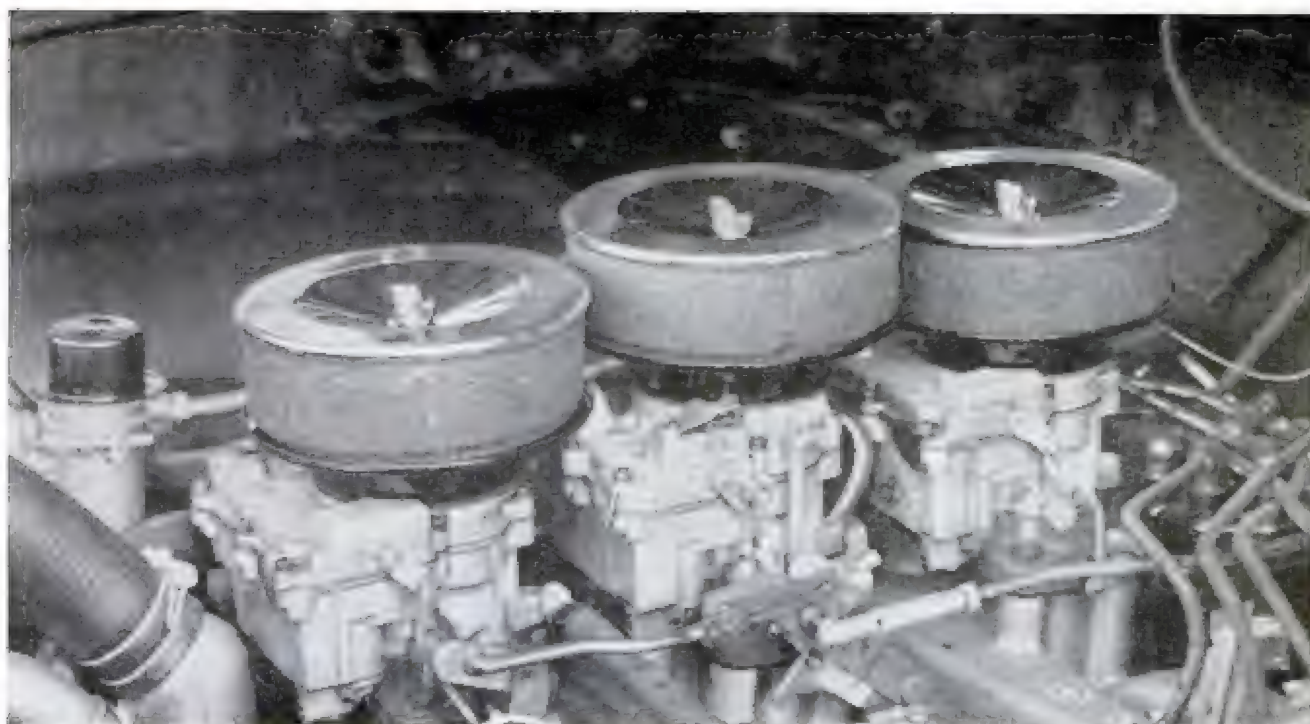
We can get away with these relatively crude carburetors on small engines because they don't have to operate efficiently over a wide range of speeds and loads.

A car engine is just the opposite. Most of the time it's cruising at relatively low speed and light load. Yet it must develop maximum power for quick pickup and must have the right fuel mixture for a smooth idle. Also, it must have instant response when you punch the throttle.

Auto engineers recognized this 50 or 60 years ago. Liquid fuel and gaseous air follow different physical laws as they flow through the carburetor—air can compress and expand, fuel cannot. Thus, when air flows through the venturi throat to create a suction, its pressure drops and it expands, it becomes less dense, and weighs less per cubic foot. As more air flows through the venturi, the vacuum at the throat increases and air density drops even more. Meanwhile, the fuel doesn't



IMPORTANT ADJUSTMENTS on modern carburetor are (A) idle mixture needle screw, (B) idle speed screw



THREE TWO-BARREL CARBURETORS afford maximum breathing, eye-popping performance. Progressive linkage allows engine to "cruise" at medium speeds on just middle carb, kicks in all three when throttle's floored

know this. Its nozzle and jet continue to meter the same volume of fuel for each cubic foot of air going into the engine. Result: With a simple carburetor, the air/fuel mixture gets richer as the throttle is opened wider. This, of course, would never do for an automotive engine at cruising speeds.

Early carburetors used various types of valves that would allow raw air into the manifold to keep the mixture from becoming richer as carburetor air flow increased. They were operated by venturi throat vacuum, causing the valve to open wider as engine speed increased.

Modern carburetors solve this problem by metering the fuel required over three different speed ranges. The first is for idling and very low speeds; the second, a main metering circuit, is for cruising; the third is a "power" system giving that extra-rich mixture necessary for maximum power (around 12-to-1 air/fuel ratio). The fuel inlet for idle, through the side of the throttle barrel below the butterfly, feeds fuel only at idle and very low speeds, when the throttle is nearly closed. The high vacuum in the manifold actually sucks fuel out.

At cruising speeds, with larger throttle openings, the main metering circuit takes over, feeding fuel from a nozzle in the venturi throat. The fuel is controlled by calibrated jets in the circuit. Then, at

full throttle, the "power" system provides the necessary rich mixture by opening a vacuum-operated fuel valve or by moving a metering rod in a fixed jet.

Another modern carburetor feature is the accelerator pump. If you open the throttle quickly, it trips a plunger in the carburetor that squirts a shot of raw fuel into the manifold to give a rich mixture to keep the engine from balking.

One of the toughest problems for a carburetor designer is how much capacity—total venturi area—to use for a given engine. For maximum power we want big carburetor throats and lots of 'em to minimize breathing restriction at high engine speed. But when cruising at low speed, all this venturi area would actually hurt performance. Air velocity through the throats would be so low that throttle response would be sluggish, gas mileage would drop off, and even engine torque would be lessened.

Auto engineers have tried to get around this compromise for years. The best answer so far is the four-barrel carburetor, designed so you can run on just the two front barrels about 95 percent of the time. Only when you push the throttle pedal about three-fourths of the way to the floor do the two rear barrels cut in to give you that extra burst of power.

It's a good compromise system. In fact,

(Please turn to page 184)



Stair-climbing chair is operated by pushbutton to take an invalid all over his house. Three electric motors drive the chair's tracks and keep the seat level. The new German device must be plugged into a house current to operate the motors. Outdoors, it can be operated manually by the rider or by a second person pushing it.



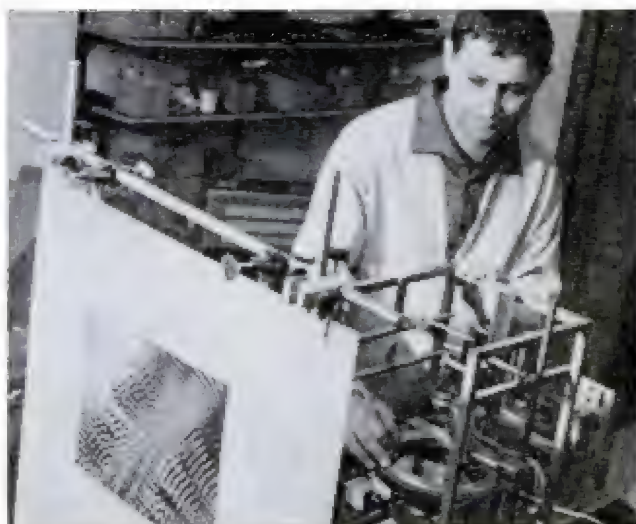
At a steady 10 mph, a plucky British draftsman, Jim Parkinson, drove this tiny car 15,000 miles on a recent round-the-world tour. The little auto, originally built as a fairground attraction, is powered by a lawnmower engine that develops five-eighths hp. Parkinson reported that he was pelted with money while driving in Russia, and that the Japanese promptly put him on a television show when he arrived in their country.



Glazed concrete hardly seems like the ideal surface for motorcycle racing—but it is in terms of turning a wild sport into an even wilder one for riders and spectators alike. Cycle riders who have raced recently in the Long Beach (Calif.) Sports Arena say that the $\frac{1}{8}$ -mile glazed-concrete track (top photo, far left) has good traction—up to a point. When the cycles lose traction, they slide as if they were on ice, generally bowling over other contestants like tenpins (lower photo, far left). Since the metal plate generally used by motorcyclists on their left boots has been barred from the concrete track, most riders tape cardboard or rags (left) on their boots. They've also found that extra padding in their riding leathers is a benefit when they're dumped onto the concrete during a spill.



Iron Horse for the highway. Converted from a seven-passenger Stanley touring car, this steam engine is still operated occasionally by its owner, Robert Lyon of Chicago. The original 20-hp, two-cycle engine drives it up to 45 mph. "Tender" at the rear is a 100-gallon water tank. The original Stanley upright fire-tube boiler was replaced with a monotube type, which is fired from the top down by a household-type oil burner.



That's music on the screen. This new German machine, called an "Audioskop," transmits vibrations from tape-recorded music to a membrane covered with a liquid, which swings in a lens system. The "sound-figures" are then projected onto the screen.



SKI PARALLEL IN ONE DAY

If you suffer from sitzmarkitis, reverse-shoulder blues or downhill-turn tremors, forget it! With Shortee skis and three simple movements anyone can ski like an expert

By **STUART JAMES**, *PM Outdoors Editor*

Illustration by **Gil Evans**



SOARING through an effortless turn, Shortee ski inventor Clif Taylor leads two of his pupils through a graceful series of linked downhill turns.

"THE TROUBLE with the short ski," said one critic, "is that you can't get the speed you get from a long ski."

Another critic complained that the short ski is not good for deep powder.

A professional instructor went so far as to say that the short ski is a deception, that it makes the technical art of skiing seem too simple.

Despite the critics and detractors, the ranks of Shortee skiers grows each year. Last year I joined them, and for the first time I really had fun on skis.

Frankly, I'm not interested in racing speed on skis. As a matter of fact, I've spent weeks taking lessons on how to slow them down. The Shortee ski is plenty fast enough for me. As for deep powder, unless you ski the Rockies or Sierra Nevadas you'll hardly ever see it. But if you do, the four-foot Shortee will soar through powder like a sailplane on a thermal. The argument that the Shortee ski is a detrimental shortcut to skiing is like saying that the automatic transmission has taken the fun out of driving.

In one day I became an unabashed fan of the Shortees. After one hour of instruction I was skiing with better form than I had ever known, and I was skiing with complete confidence in my ability to handle the skis in any situation.

Inventor, prophet and promoter of the Shortee ski is Clif Taylor, a tall, ruggedly handsome professional skier who spends 12 months a year barnstorming the country to drum up enthusiasm for his sawed-off staves. When an instructor of U.S. Army ski troops in World War II, Taylor conceived the short ski as a method of teaching proficiency on skis in the shortest possible time. Since then, he's perfected



THREE BASIC TURNS can be learned at home with piece of heavy cardboard. Stand on cardboard (above) in relaxed position, knees slightly flexed. Turn both feet (below) for foot turn. Leg turn, executed by leg below knee, moves skis in little wider arc than foot turn. Hip turn (power turn for sudden stop or long turn) utilizes the full leg from the hip





FOOT TURN is simple maneuver. You traverse slightly to left of fall line. Your body (A) faces downhill at all times. Stand directly over skis, knees slightly flexed. As you turn foot at ankle (B), tips of skis automatically come to right (C). Pivot is made on balls of feet (D). Full sweep of ski tips from left to right (E) is only about 12 inches. Repeat maneuver in the opposite direction to maintain desired speed and control

the ski and simplified the teaching method.

I went to Brattleboro, Vt., to meet Taylor and try out his system. My first surprise was that initial practice began indoors. I was given a rectangular piece of heavy cardboard upon which was printed a pair of two-and-a-half foot skis. I stood on this cardboard and faced a large piece of paper on which was printed a half-moon-shaped diagram. With this device I was to learn the three basic movements that comprise the Taylor Method—foot turns, leg turns, and hip turns.

I stood relaxed, knees bent slightly, feet flat on the cardboard. I faced the center line on the diagram sheet. With my arms slightly outstretched for balance, I turned both feet to the right, making the movement from the ankle. Back to the center line, then to the left. It was jerky and awkward at first, but after a few times I had adjusted the weight on the cardboard so that it moved smoothly, and then I made the foot turns to a counted rhythm.

Leg turns are easier. The entire movement is made by the leg below the knee. Since you have more power, the movement of the cardboard is more pronounced and the rhythm more easily attained.

The hip turn is executed by a full turn of the legs from the hip. The movement is much the same as one would execute for sliding sideways on ice.

When I had achieved a degree of good rhythm in these three movements, we turned on some dance music and I kept time to the music, mixing up the different movements.

If this seems too easy to transfer directly to the ski slope, then you're feeling just as I did the next day when I snapped the bindings on a pair of real two-and-a-half foot Shortees at Hogback Ski Area near Brattleboro. I had been a real hot-shot on a smooth carpet. A ski slope would be different.

But we didn't go on a ski slope. "It's always best to start on flat ground," Clif explained. "Walk on the skis. Tramp around. Make turns. Try some skating. You'll see how easy they are to handle."

"How about ski poles?" I asked.

"You won't need them. You can use them later if you want to, but in the beginning it is best to keep the hands free and the arms swinging to get the feeling of a natural body rhythm."



SMOOTH AND RHYTHMIC, leg turn is like dancing down the slope. Lower leg turns from knee, and the greater power makes it a longer and more graceful turn than the foot turn. It slows you, but is the common maneuver for relaxed, linked turns downhill

SPECTACULAR SWEEPING TURNS and sudden sliding stops are executed with hip turn. With body facing downhill, entire hip is rotated in direction you want to turn. The body twists below waist, and upper body remains faced toward the direction of descent

I walked and skated around, and I practiced jumping straight into the air and making a full turn. The small skis were easy to handle, and I was reminded of the first time I headed for the novice area on a pair of seven-foot skis. I made it about 50 feet from the ski shop and then ended up in a mess of skis, poles and legs that took three persons to untangle.

The first official instruction was to stand in one place on level ground, then repeat the foot turn exercises I had practiced the night before. It was more difficult.

"Don't lean forward," Clif said. "Just relax and stand over the skis. The weight is on the balls of your feet, and keep your heels down."

For the next 10 minutes I stood in position and went through the three basic movements, making a butterfly pattern in the snow. Then we moved on to a gentle slope.

"Always start on a nice easy slope," Clif said. "This is particularly important for the person who is teaching himself."

I went down the slope. I made a series of foot turns, counting aloud to maintain the rhythm. I stopped at the bottom,

walked back up and repeated the maneuver. As before, it was jerky and erratic at first, but I very quickly learned that when I turned my foot the ski turned, and then I gradually worked up a sense of timing that resulted in a relatively smooth pattern.

I practiced for a half hour and then Clif said, "Okay, let's go up." We took the T-bar to the top of the novice slope.

"Do you always go up on the slope this fast with a beginner?" I asked.

"It's the best way to learn," Clif said. "All of the technique of skiing boils down to making the skis turn. When you turn the skis at will you have control over your downhill flight, and that's all there is to it."

I was still a bit skeptical, and the first time I tried to stop on a fast descent I fell back on long-ski technique. I weighted the downhill ski, unweighted with an upward movement, then weighted again with a full hip thrust. Instead of stopping I spun completely around.

"Now do you believe they're easy to turn?" Clif asked, chuckling. "You don't

(Please turn to page 209)



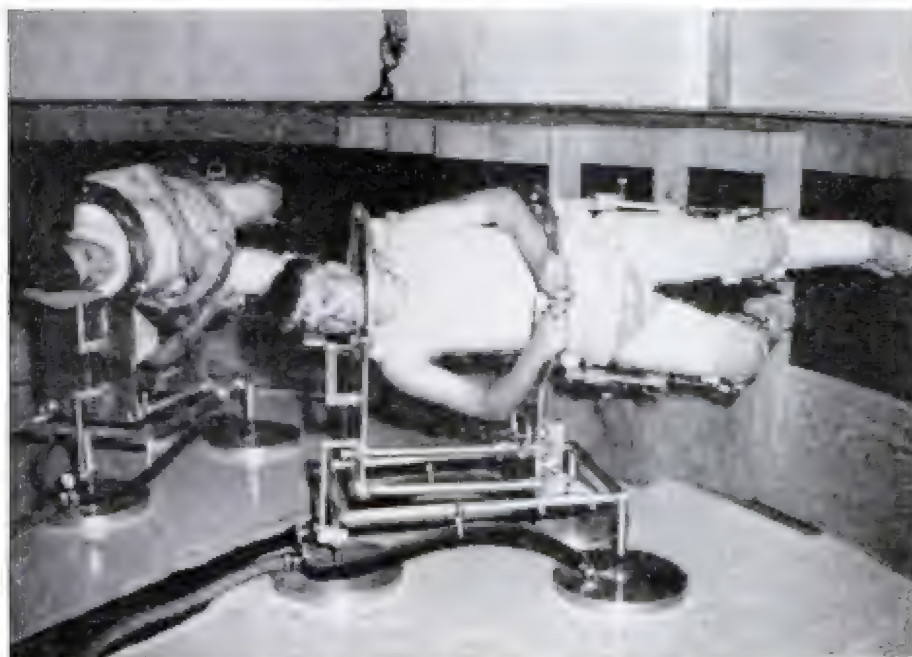
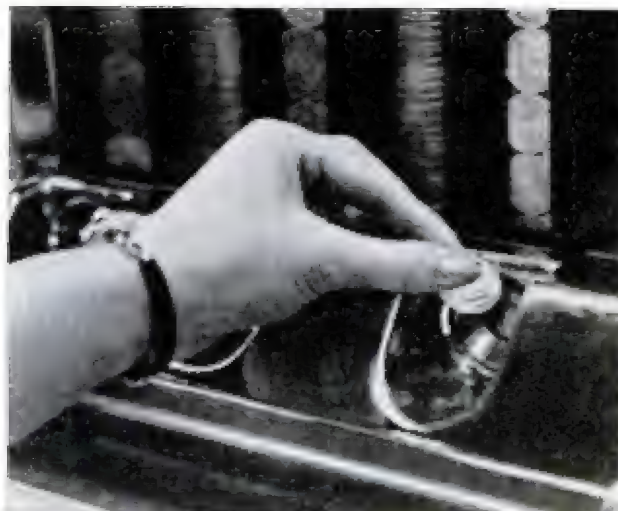
Automatic blackjack is now going for the house in a Reno gambling emporium. The \$50,000 machine accepts quarter, half-dollar and silver-dollar coins (far right)—up to five of each, or a total of \$8.75 from each player—and deals four hands which are displayed on a screen (right). Each player then pushes his button (right, center) for a "hit" or "stand." After all players are through, the machine plays its hand, and winners, if any, are paid off just as on slot machines. The automatic dealer was developed by a retired electronics engineer. He started it as a hobby 10 years ago and now hopes to automate other gambling games, too.



Compact Microgiro, a one-man autogyro designed and built by a mechanic with the French Ministry of Aviation, uses a 72-hp engine to power its pusher propeller. Its main rotor blade, made of spruce, is 20½ feet long. The mechanic, Francois Usust, is now working on a combination gyro-helicopter with an auxiliary engine to drive the main rotor blade.



Snow cycle is a conversion from a standard lightweight motorcycle made by the attachment of tracks and skis. Called the Cycle Sno-Go, the accessory package consists of two three-wheel tracks that replace the rear wheel of the motorcycle (center, left) and two skis mounted on a framework. The rear wheel is removed, and the rear axle is dropped onto the track unit and attached by a few bolts and the drive chain. The front wheel rests on a cradle on the ski frame (left), although some cyclists have used the rig without the skis. The whole assembly weighs 130 pounds and can be carried in a car trunk. Top speed with the rig is about 20 mph. It is distributed by Johnson Motors, Inc., 267 W. Colorado Blvd., Pasadena, Calif.



Walking on walls for the sake of science is a routine activity of several sober volunteers at the Naval Aerospace Medical Institute, Pensacola, Fla. Lying sideways and supported by frames that glide on air-cushion "bearings," the men walk on the walls of a rotating room to study their orientation to an environment similar to a rotating spacecraft.

POOR MAN'S BACK-YARD WHIRLYBIRD

Its makers, both in their twenties, hope to market their one-man helicopter for under \$10,000

By KEVIN V. BROWN
Pictures by John E. Boykin



B. J. SCHRAMM'S FIRST NAME is Buford but, understandably, he insists on "B.J." He has some other definite ideas, mostly about helicopters. He first started thinking about them in high school and, before finishing college (he still hasn't), he designed and built one.

He moved so fast, in fact, he had his helicopter built before he ever learned to fly one. Now everyone may be flying one.

Schramm's *Javelin* is a one-man whirlybird that may lead the long-awaited breakthrough in back-yard aircraft. He hopes to market it for less than \$10,000, about half what the lowest-priced helicopter is selling for now.

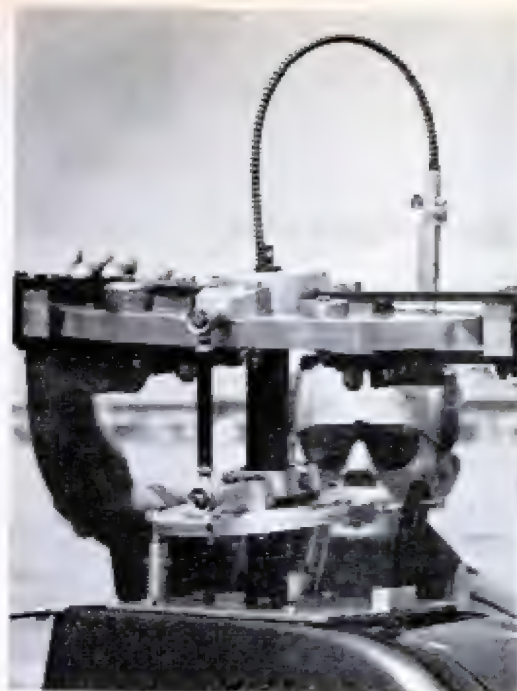
Schramm had some help from another college dropout, Robert Everts, an excellent mechanic and designer. They did just about all the work on the bird themselves.

"We had three things in mind," Schramm explains, "low cost, stability and easy maintenance. We have about 30 percent fewer parts than a standard helicopter, and the design is so simple a shoe clerk could take it apart in an hour and a half.

"Finally, we wanted it stable enough so the general public could fly it. We've designed it so that it wants to stay level, with an inherent tendency to return to the stable mode."

Straight up, anyone?

★★★



DESIGN SIMPLICITY was one aim of Schramm helicopter, reducing cost with fewer initial parts and easier maintenance



ONE-MAN COCKPIT has standard basic instruments and controls, including a cyclic-control stick and collective pitch throttle



SCHRAMM HELICOPTER weighs 500 pounds empty and can easily be handled by one man. Engine is 100 hp and can power it to 100 mph up to a ceiling of about 12,000 feet



B. J. SCHRAMM (left) and Robert Everts, both in late twenties, designed and built Javelin themselves



LIGHTWEIGHT WHIRLYBIRD can be towed home behind lightweight compact without any dismantling

NEW FOR YOUR HOME

BY CAROL SCHULTZ



KITCHEN DISPENSER with hinged slate front acts as message center when closed. Holds wax paper, foil, towel rolls; fits 14½ by 11-inch wall hole. Comes in various colors. \$19.95. Nautilus Industries, Freeland, Pa.



ELECTRONIC-ARC GAS RANGE ignites top burners, oven and broiler two seconds after being turned on. "Pilotless" range promises advantages of safety and economy. Offered at \$469.95 by Sears, Roebuck & Co.



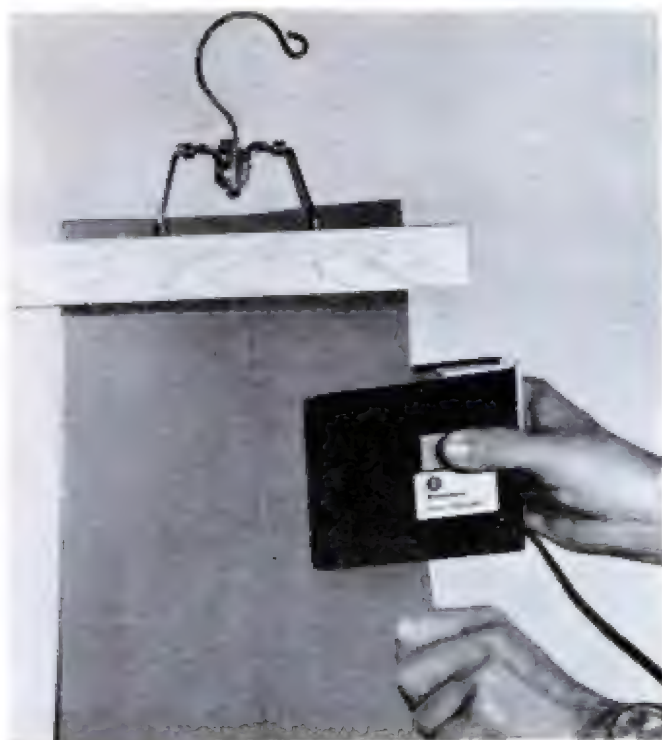
CHEST FREEZER now comes in a compact 5.7-cu.-ft. unit: 38¾ inches high, 22¾ inches deep, 30¼ inches wide. Laminated plastic finish has handsome look of grained light walnut. \$149.95. By Montgomery Ward.



CHRISTMAS-TREE ROTATOR has built-in music box. Finished in white with gold pattern, unit adapts to any artificial tree to 7-foot height, 25-pound weight, and 1¾-inch trunk diameter. \$39.95. By General Electric.



AUTOMATIC FOOD WARMER is answer to cooking full meal in advance and keeping it piping hot for hours at just-cooked flavor. Large swing-out bin keeps rolls or pie hot through meal. Contemporary styling, rich walnut handles and inlays make warmer an attractive addition to table or buffet. Unit has a "hot spot" for coffee, adjustable thermostatic control, is 22½ inches long, 11 inches wide, 4½ inches high. \$32.50. Salton Inc., 519 East 72 St., New York.



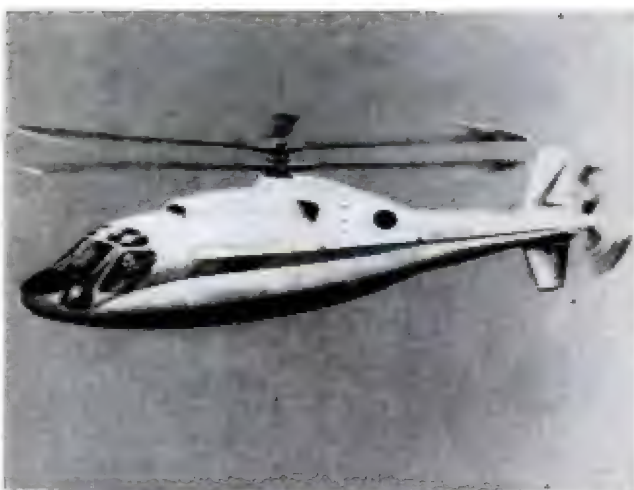
STEAM PRESS VALET fits easily in your hand for instant steam pressing of trousers, pleated skirts, neckties and similar garments. Just add water, plug in and it's ready. The unit costs \$19.95. By Westinghouse.



SEVEN-SPEED BLENDER ranges from "whip" to "liquefy" to simplify recipes. Non-drip jar cleans easily, is removable while in operation and measures up to 48 ounces. \$49.95. By Iona Mfg. Co., Manchester, Conn.



You can surf, sail or powerboat on the Sportboard, a versatile new craft that adapts to any of these activities. A 5-hp engine inserted into the hull (left) allows the rider to travel up to 15 mph lying down (above) or standing. Also available are a complete sail rig and a see-through insert for the engine well that enables the user to peer into the water. The 14-foot, 3-inch fiberglass board is by Berkshire Crafts, Havertown, Pa.



350-mph helicopter is the hope of the Sikorsky Aircraft Co., which recently came up with this concept of a light chopper that will be built to travel that fast. The twin rotors will be mounted on a single axis, and the blades will be rigid (rather than mounted with hinges or flexible joints). A pusher propeller at the rear of the craft provides auxiliary forward thrust.



Salt and pepper for fish? Not really; the shakers were submerged in water just to demonstrate their resistance to moisture. The seasonings come out the bottom of the shakers. The plastic Aridsel shakers are made by the Selco Co., Radnor, Pa.

2 ROOMS FROM 1



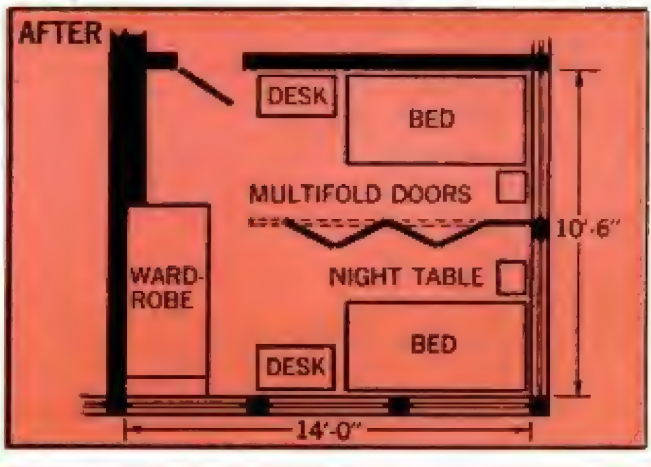
PULLING WALL OF GANGED DOORS across youngsters' bedroom divides it in half to create two separate areas for both sleeping and study

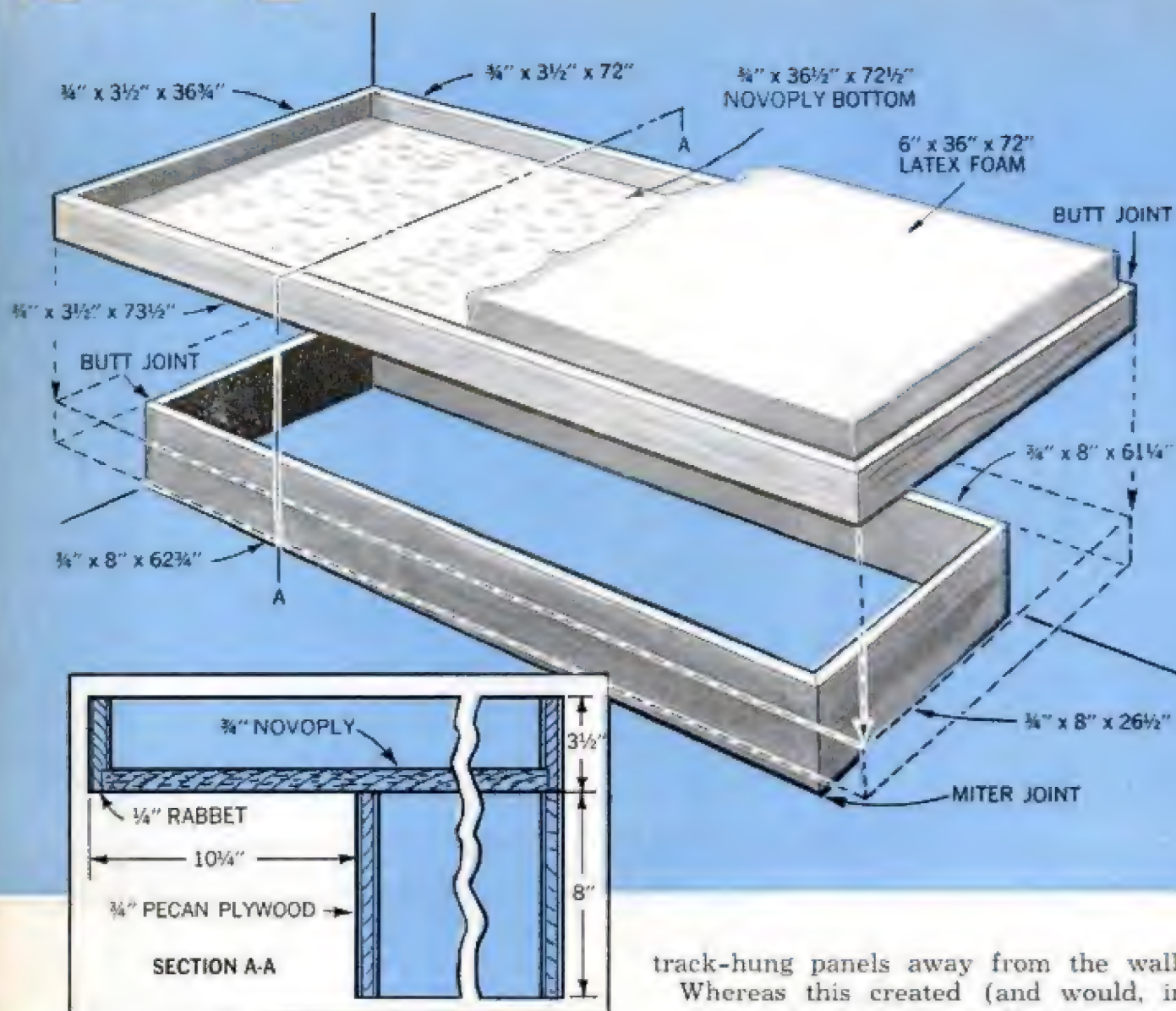
Accordion wall down the middle can solve your space problem when two youngsters reach the age of wanting a room of their own

Illustrations by Frank A. Taggart

WHAT CAN YOU DO when two youngsters, who occupy the same bedroom, each needs a semiprivate place to study? If this is your problem, perhaps you can solve it by taking an idea from Bill Baker's 100-year-old dream home in Westport, Conn. (page 139, Sept. '66 PM).

Faced with such a problem, Baker cleverly split a bedroom down the middle with an accordion-fold wall of flush doors which made it possible to divide the room into two separate study areas by merely pulling the





THICK LATEX-FOAM SLABS provide comfortable mattresses for the cantilever beds. Allow 1-in. clearance

track-hung panels away from the wall.

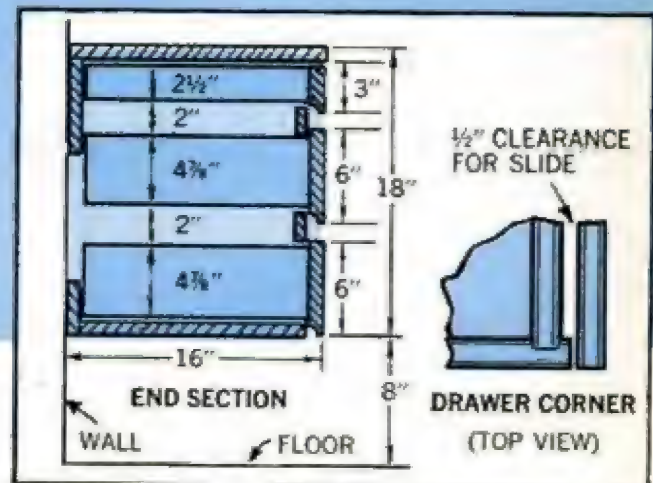
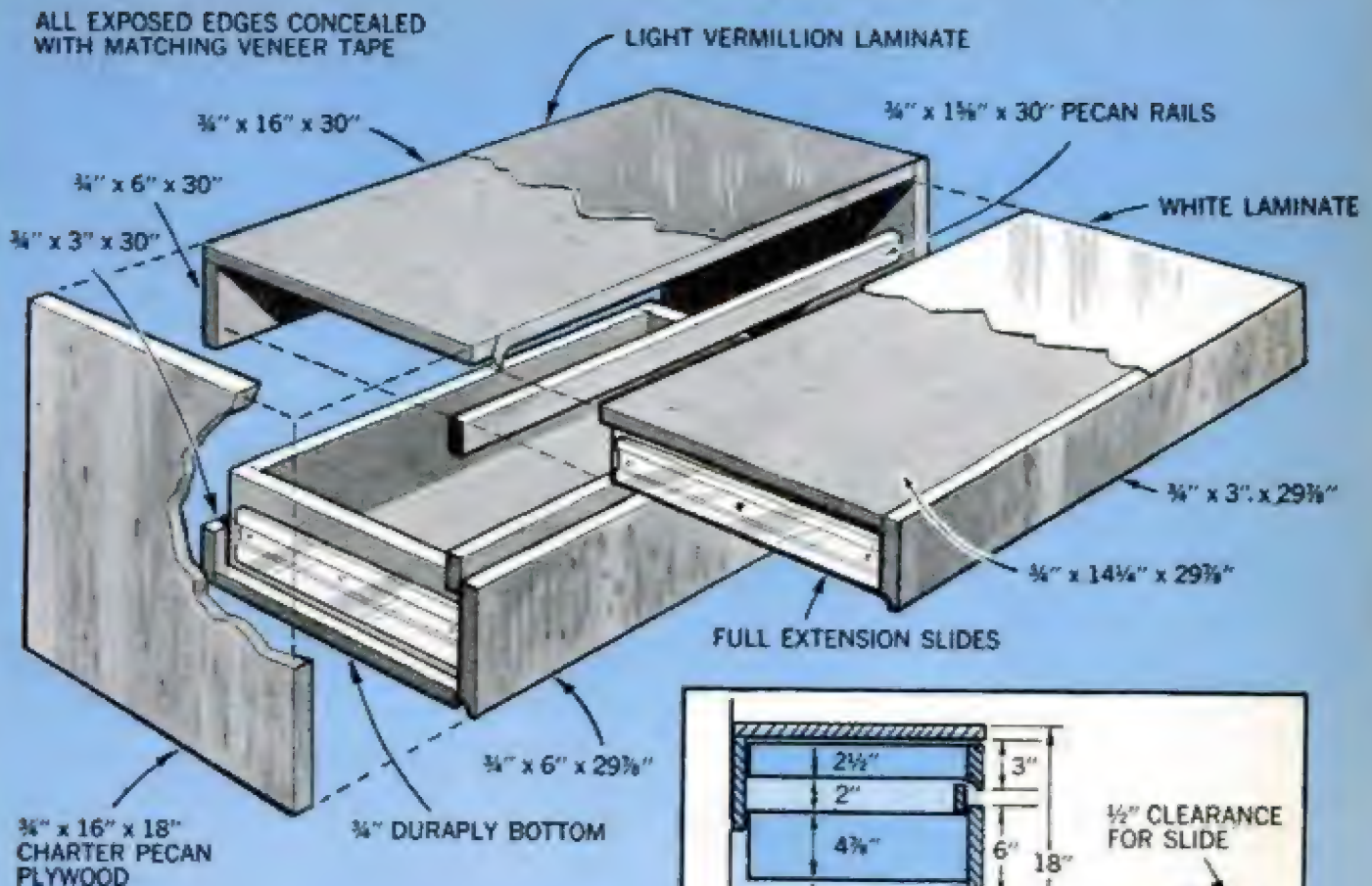
Whereas this created (and would, in most cases) areas too small to accept a regular-size bed, chest and desk for each youngster, simple wall-hung units were designed and built to solve the space problem and still provide the three pieces.

The result was twin "bedrooms" which permitted one youngster to burn the midnight oil without disturbing a younger brother or sister should he be ill or have different sleeping habits. Of course, to revert back to one large open room, a push on the piano-hinged doors folds them back on their track and against the wall.

In completely remodeling the original dated bedroom, Baker had space to include a built-in, floor-to-ceiling cabinet with chest to provide additional wardrobe storage. Details for building it are given on page 142. Whether you have room to include this too, depends upon the size and shape of your particular room.

As you can see from the photo of the completed room, shown in full color on





TOP "DRAWER" of wall-hung dresser pulls out to serve as handy writing desk for school homework

page 141, and the "before" picture on page 137, the original double-hung windows were replaced with Stanley's clerestory ones and fitted with bright lemon-yellow draw drapes. The walls were faced with U.S. Plywood's prefinished, charter-pecan paneling after they were soundproofed with Barrett's sound-deadening board; an Emerson recessed-ceiling spotlight was installed over each bed for reading, and the room was wired for an AM-FM intercom system. The old floor was renewed with Swedish-oak parquet flooring.

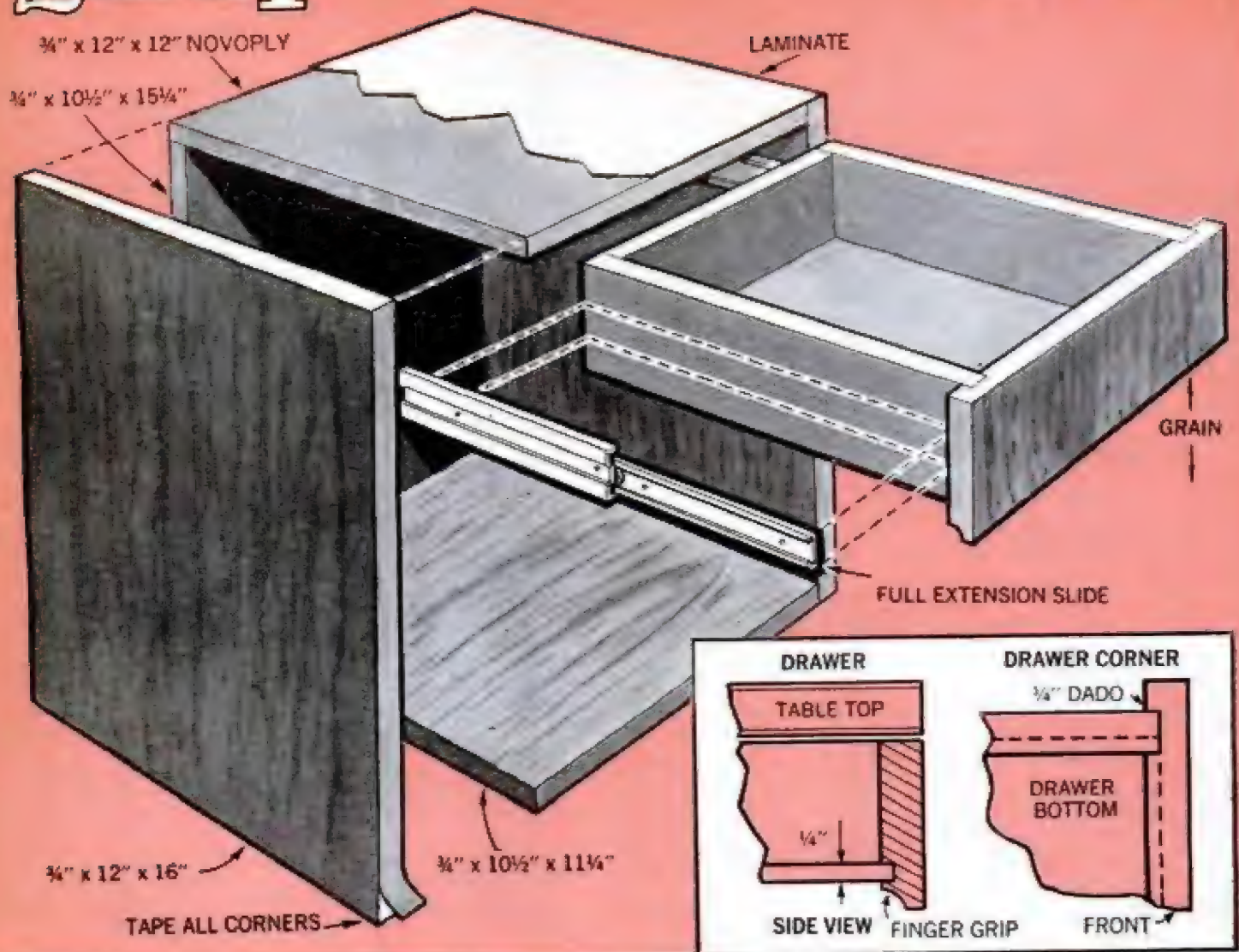
As for furniture, each "room" has identical units, consisting of a cantilever-type bed fitted with a 6-in. slab of latex foam rubber, a wall-hung night table and a wall-hung desk-dresser that has a slick pull-out writing surface. The tops of both the night tables and the desk-dressers were surfaced with Micarta laminate.

Construction of the three basic pieces is extremely simple and the use of Grant full-extension, metal drawer slides simplifies building even more. There's nothing



2 ROOMS FROM 1

NIGHT TABLE



TEMPORARY SUPPORT placed under wall-hung units helps hold them in place when attaching and leveling

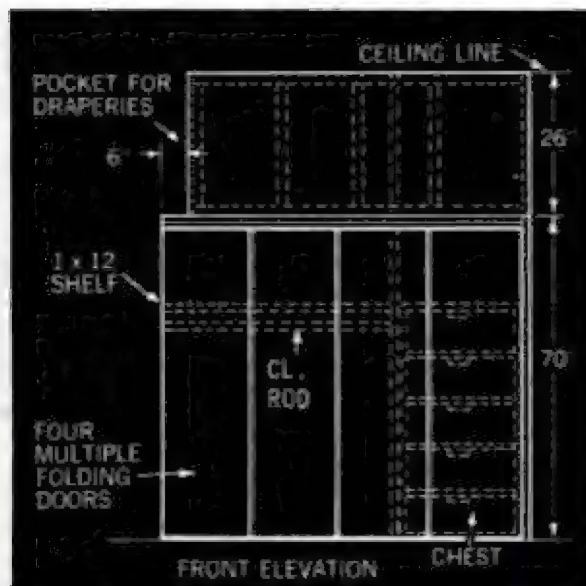
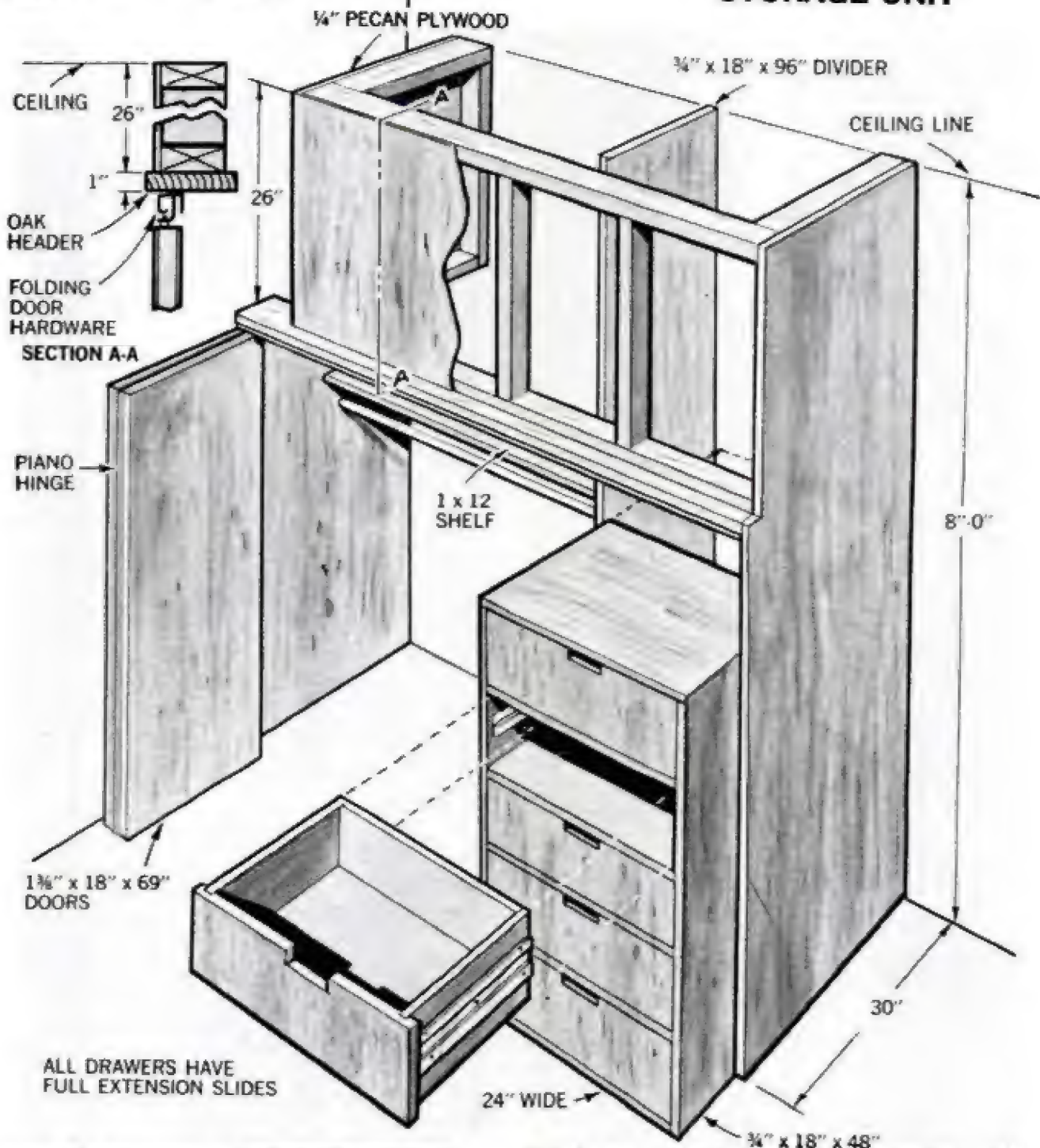
to making the single beds. The top is little more than a tray supported 8 in. off the floor by a simple base of four boards.

Since the beds are designed to fit snug in a corner, the top overhangs the base 10 in. at the front and one end and $\frac{3}{4}$ in. along the back to clear the room's baseboards. Only the outer corner of each assembly requires mitering; all the others are merely butted, glued and nailed with finishing nails. Since two of the side members are actually hidden against the walls, these parts can be made of less expensive wood. Exposed edges of the plywood numbers are covered with a matching Weldwood trim. In the case of pecan plywood, oak trim is the nearest match. The top is attached to the base with glue and nails driven through the Novoply bottom, and the completed beds are screwed in place to wall studs with $2\frac{1}{2}$ -in. #12 flat-head screws. In ordering foam for the mattresses, allow 1-in. clearance all around.

The desk and table units are open boxes



STORAGE UNIT



which are fitted with drawers that roll freely on standard metal extension slides. The construction of both pieces is clearly shown in the pull-apart drawings on pages 139 and 140. In each case, the side members lap the edges of the top so the exposed end grain will later be covered by the laminate which is bonded to the tops with contact cement. The desk-dresser looks as if it has three drawers, but the top one is actually a pull-out writing shelf which, like the drawers, is fitted with the same metal slides. Laminate also covers the writing surface, and exposed plywood edges are covered with wood trim.

In mounting both units to the wall, they

(Please turn to page 189)

make a  gift!



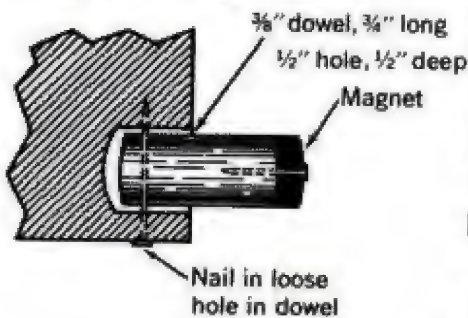
SWIVEL COUPLERS in the cars allow train to snake along as it's pulled

3 PULL-APART PULL TOYS

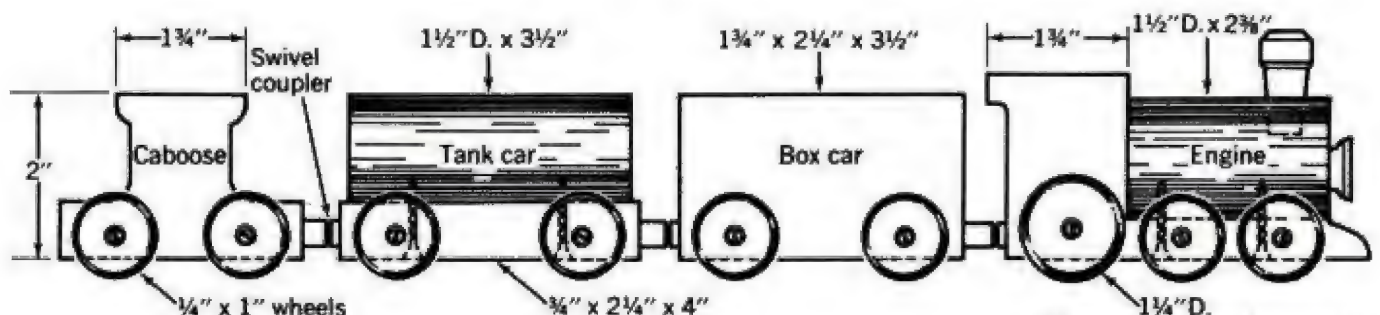
BY WILLARD AND ELMA WALTNER

Illustrations by Shannon Stirnweis

MAGNET TRAIN



TAKES NO EFFORT for little tykes to couple or uncouple the cars of this maple-block train since they're held end to end by button magnets. The magnets are pinned to the ends of short dowels which in turn are pivoted to swivel in shallow holes bored in one end of each car. Mating magnets are left loose on their pins to turn in seeking opposite poles



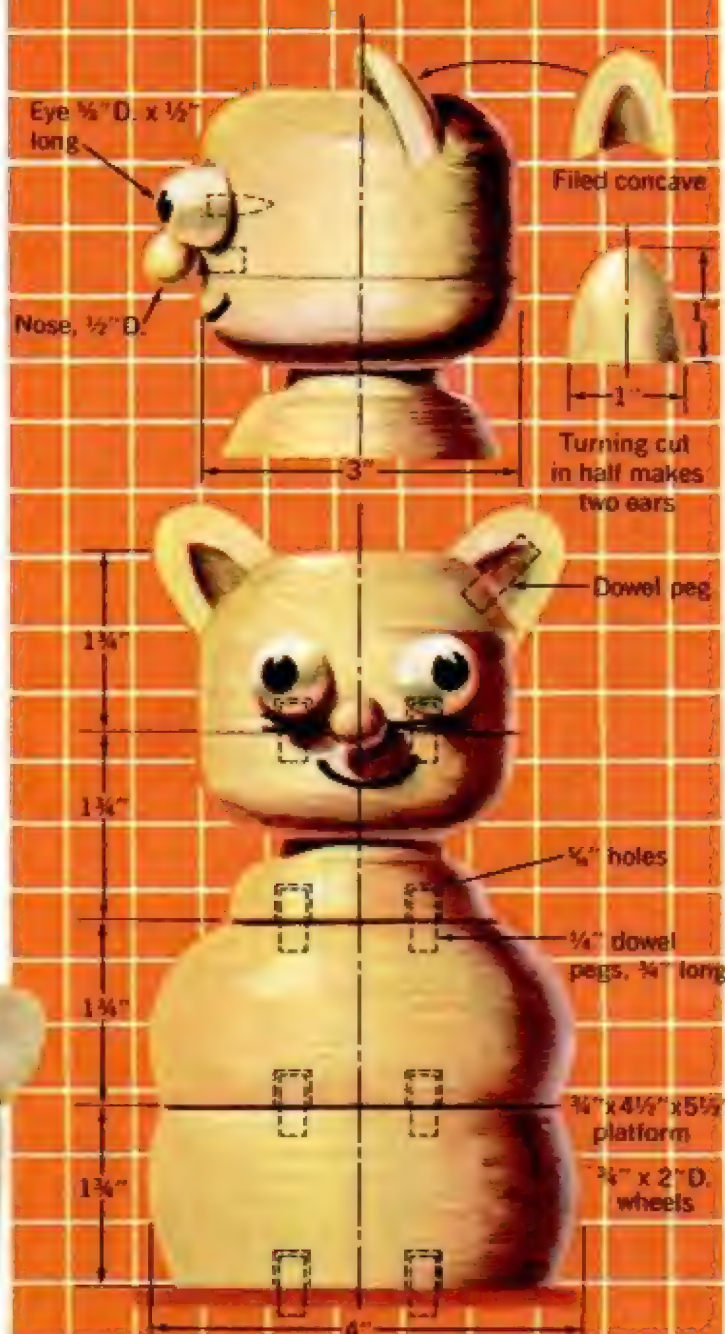
PLEASE TURN THE PAGE

3 PULL-APART PULL TOYS

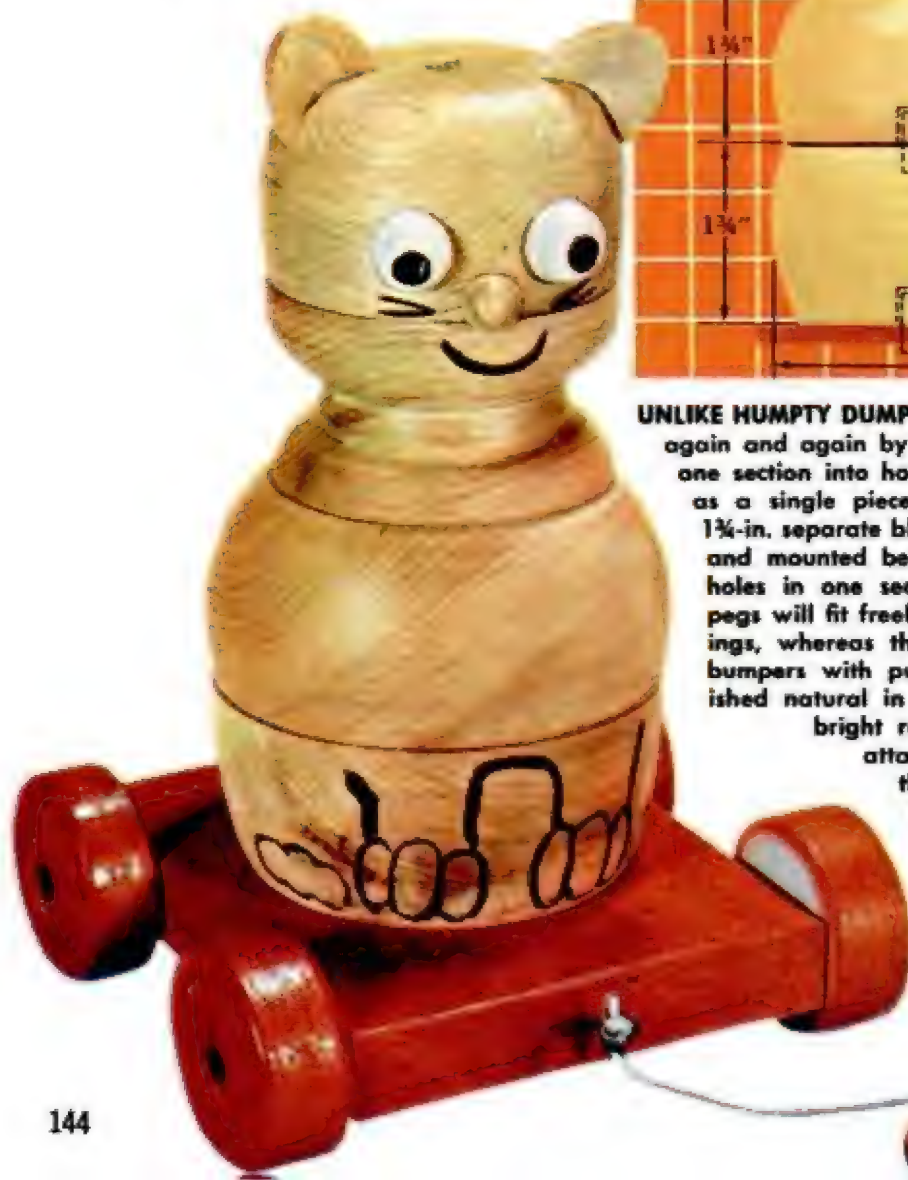
STACKIN' CAT



PAIR OF PEGS in each section make parts self-aligning when stacked in proper order



UNLIKE HUMPTY DUMPTY, Stackin' Cat can be put together again and again by little hands learning to fit pegs of one section into holes in the next. The body is turned as a single piece, even though it consists of four 1 3/4-in. separate blocks pegged together (without glue) and mounted between lathe centers. After turning, holes in one section are enlarged slightly so that pegs will fit freely. Ears and nose are separate turnings, whereas the eyes are white rubber furniture bumpers with pupils painted black. The cat is finished natural in nontoxic paints and it rides on a bright red wagon fitted with a pull string attached to a screw eye. Two pegs in the wagon keep the cat from falling off. All pegs should be glued in their respective parts or can be simply forced in undersize holes.

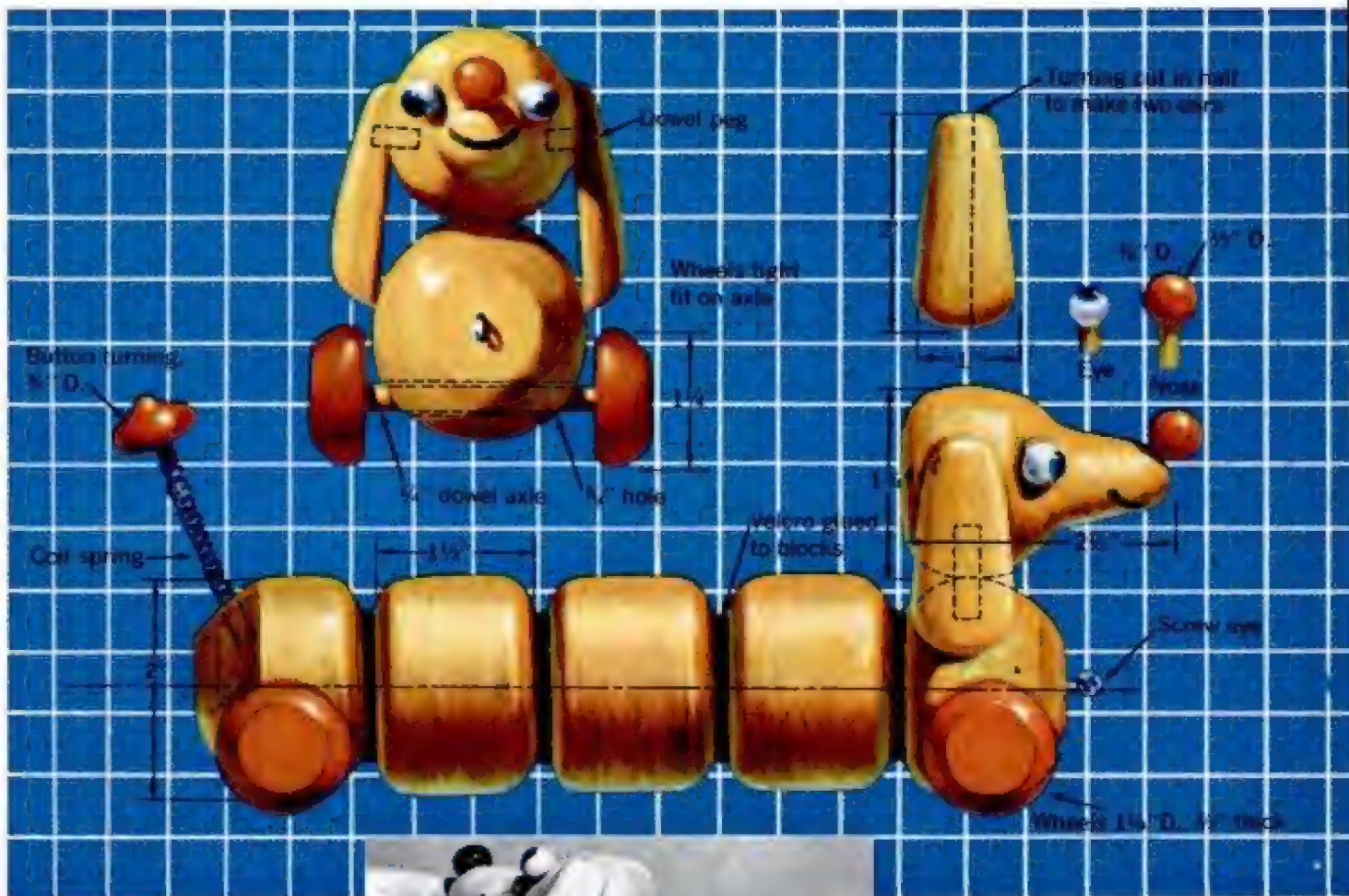


make a  gift!

STICKY DOG



LIKE THE OTHER TWO TOYS, this cute take-apart hound will help teach little hands coordination and manipulation. You can make his body three, four or five sections long from smooth blocks of splinter-free maple, all turned alike on the lathe. One-inch discs of Velcro, which are used to stick the sections together, are glued to 1-in. discs of felt. Then after color-keying the end surfaces of the turned parts, red for one, blue for another and so on, the Velcro discs are cemented in the center of the painted spots so exposed color around edges of discs will indicate proper ends to press together to make up train in order shown





How to Take Better Christmas Pictures

PHOTOS BY HARRIET ARNOLD



CHRISTMAS-TREE BOUGHS are normally too low to pose under. Decorate a branch and tie it to a tripod, chair or other convenient support at an appropriate height. Packages add to picture composition and hide tripod's legs



WAIT FOR THE RIGHT MOMENT or stimulate the child to action. Here you have a close-range shot with a minimum of elements and a good focal point. Another light should have been thrown on the wall to kill unwanted shadow

SET UP YOUR BACKGROUNDS FOR MAXIMUM IMPACT

SHOOTING A FAMILY ALBUM for Christmas is a favorite holiday pastime, but all too often the results are disappointing. They needn't be, however, whether you use a box camera or an adjustable one. All you need is some advance planning.

Here and on the following page are some pointers for creating some memorable Christmas portraits.

The principles are few. Christmas scenes involve the tree, decorations, packages and the home furnishings, as well as your subject. Working with all these elements at once is what usually kills your shots. So don't try to include everything in one picture. Keep backgrounds uncluttered and the subject simple, even to breaking up family groupings into more manageable portions of one, two or three persons. Then seek a focal point of action to create in-

terest. Finally, expect the unexpected: Some of your best shots will be the unplanned ones—the spontaneous expressions or gestures.

This shooting session is best handled
(More photos, page 148; text, page 210)

TOO CLUTTERED is how to describe this shot. The floral-print sofa, plus table and the picture frame interfering with the tree bough, make it too busy, detracting from the child



Don't...



... **LET FOCAL POINT GET LOST**, particularly when you have a busy subject, such as these four children, the tree, packages, doors



... **POSE YOUR SUBJECTS**—you'll get wooden smiles and unnatural positions, particularly with older children. Seek some spontaneity



... **CHANCE UNWANTED REFLECTIONS**. Be wary of mirrors, glass-fronted picture frames and other shiny surfaces when you light scene

Do...



... **CREATE A CENTER OF INTEREST**, the baby in this case. Buy or dye matching pajama sets to simplify subject and heighten focus

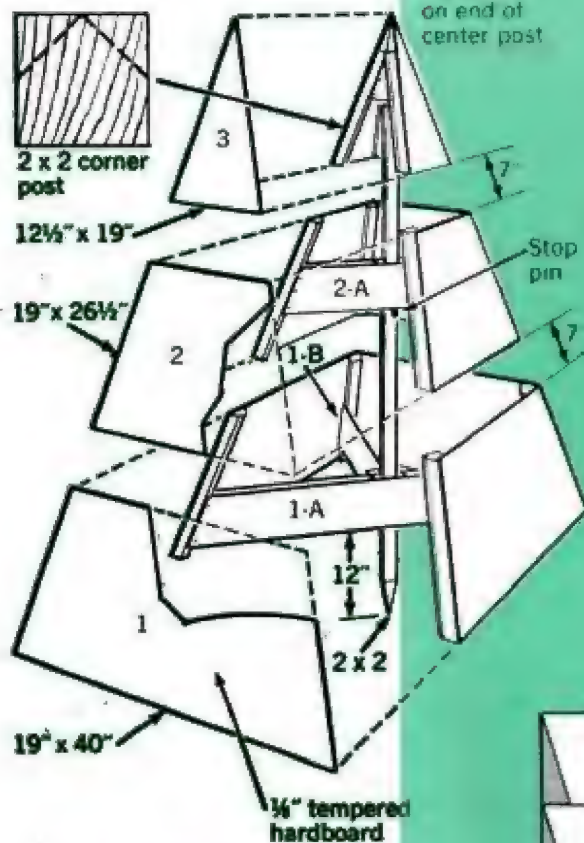


... **LET YOUR SUBJECTS RELAX**. Have your helper distract them at an angle away from the camera, and then wait for peak moment

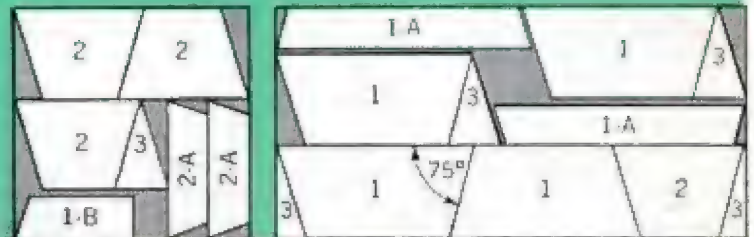


... **CHANGE LIGHT OR SHOOTING ANGLE**. Bounce lighting is useful here. Note the informal grouping of the family for this pose

Pyramid "tree" brightens your lawn on yule evenings



ALL PIECES CUT OUT of a 4x4 and a 4x8-ft. sheet of hardboard (right)

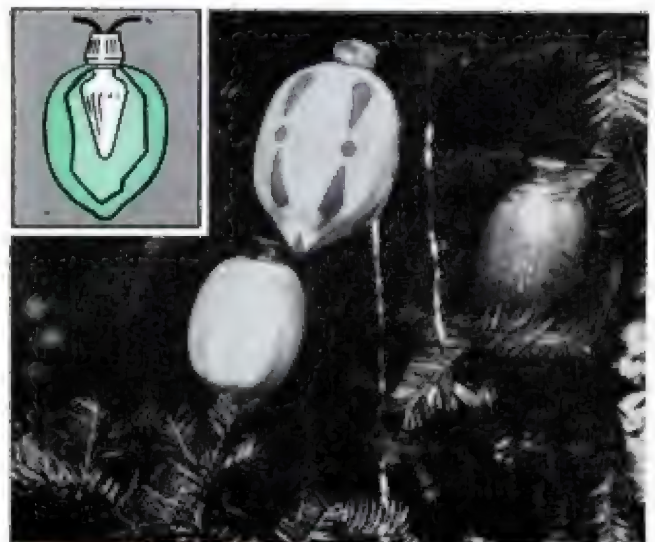


Made by nailing $\frac{1}{8}$ -in. tempered hardboard over a light frame, this modernistic tree is an eye-catching lawn decoration that will give many seasons of use. The "Christmas-tree lights" are actually holes cut in the hardboard which are illuminated by a pair of outdoor spotlights pointing upward from inside the base. Cut

these holes before mounting the panels. Then, after the whole thing is assembled, give all surfaces at least two coats of flat green exterior enamel. You might also add artificial snow or glitter. To simplify storage, use bolts in part of the assembly so the tree can be broken down into flat sections.—Dave Swartwout

Tree ornaments from bottles

Those fruit-shaped, yellow and green squeeze bottles in which lime and lemon juice are sold can be transformed into warmly glowing balls of light to decorate your Christmas tree. Simply cut off the threaded top and enlarge the hole to about $\frac{5}{8}$ -in. diameter. Next, make four $\frac{1}{4}$ -in.-long slits in the edge of this hole at right angles to each other so you can poke the bottle over a C-6, 15-v. series Christmas-tree bulb. Be sure that the plastic doesn't touch the bulb. For added color when the bulbs aren't lit, paint designs on the bottles.—Frederick W. Chesson



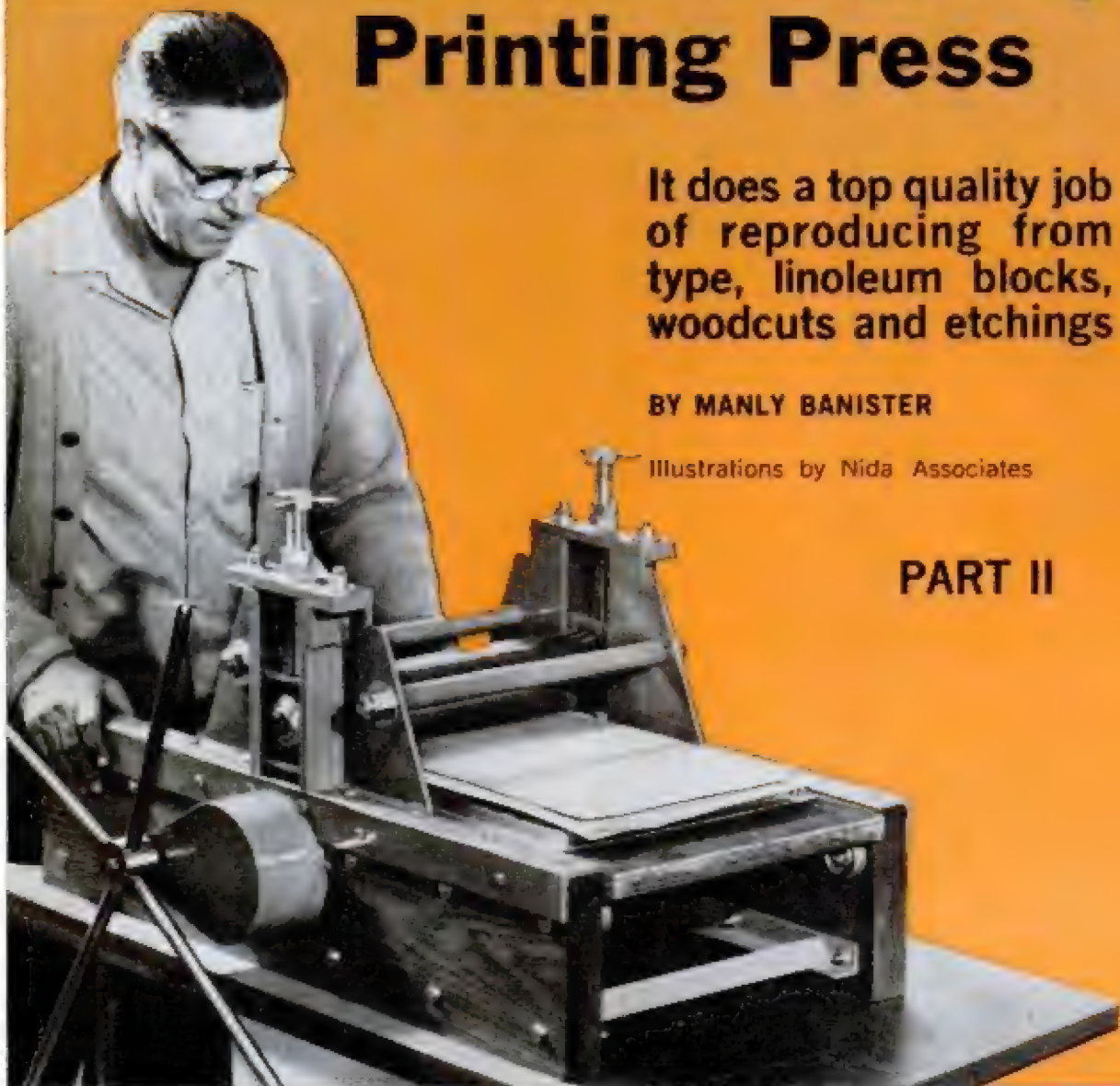
Build a Tabletop Printing Press

It does a top quality job
of reproducing from
type, linoleum blocks,
woodcuts and etchings

BY MANLY BANISTER

Illustrations by Nida Associates

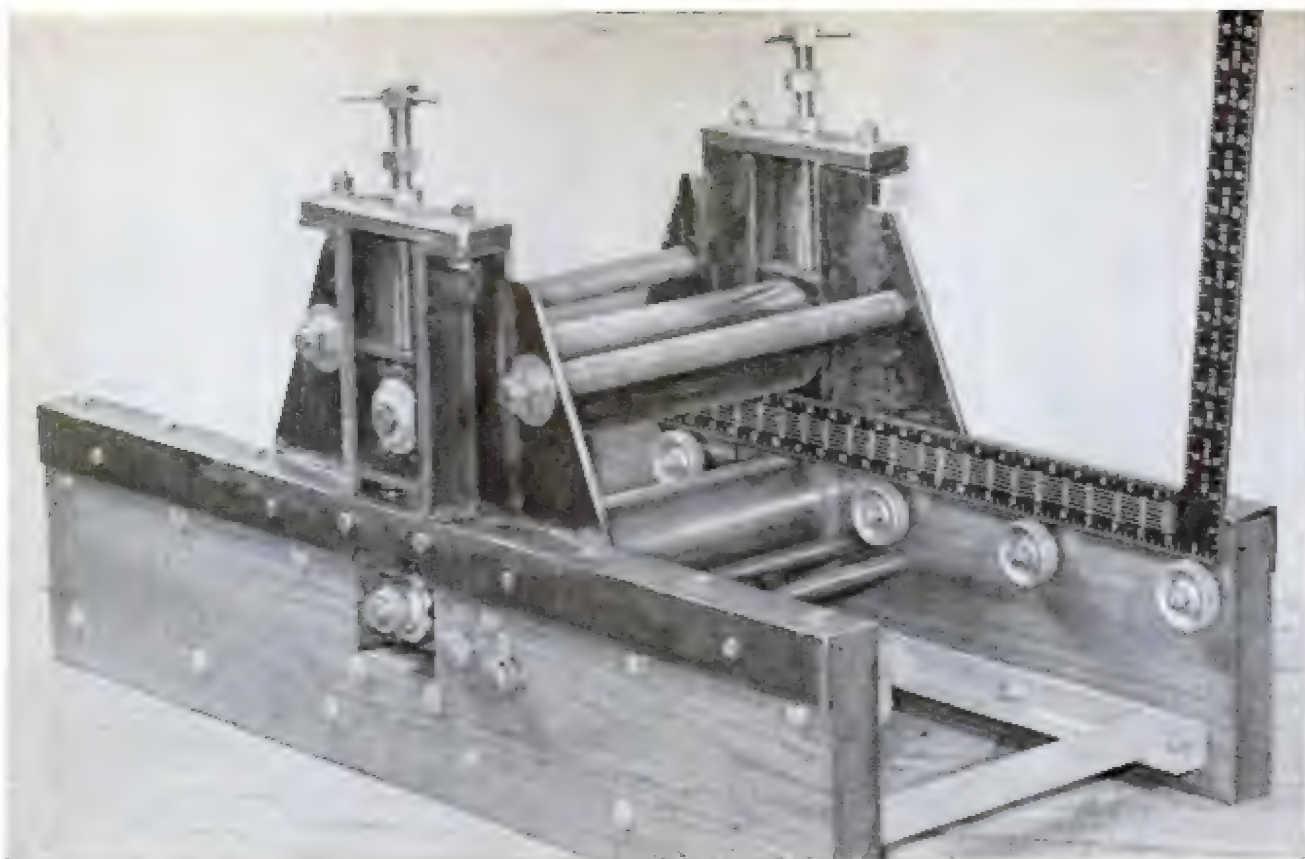
PART II



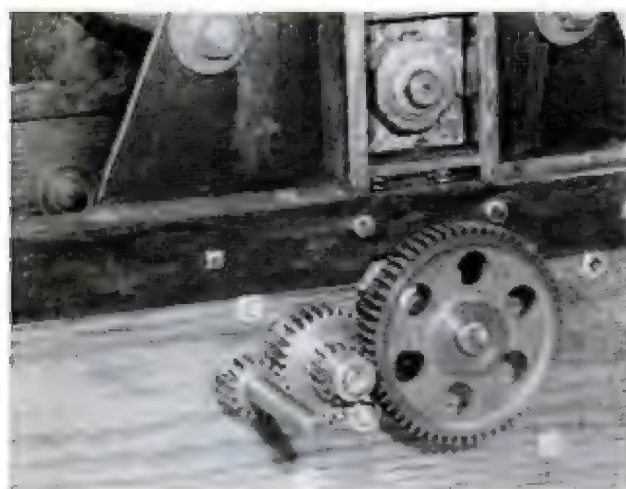
POSSIBLE REFINEMENT for press is a speed-reducer motor having gear head. It offers even feed-through



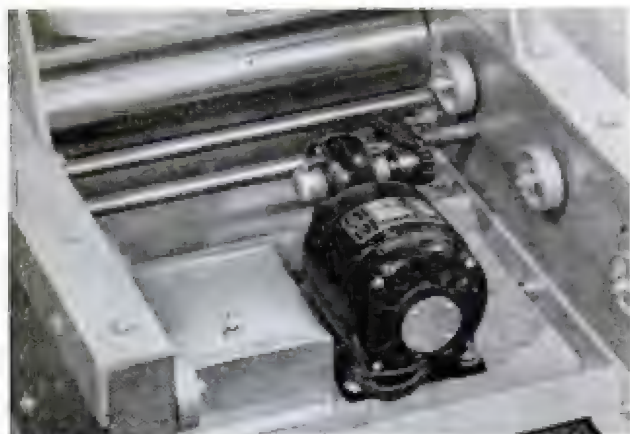
WHEN WELDING crossframe, clamp long members to welding table and hold crossmembers with bar clamps. Clamp ports securely in all welding to prevent distortion



USE STRAIGHTEDGE when installing bedrollers to line them up level with the top edge of the drive roller. If roller must be moved slightly up or down, grind out bolt hole with a bit or rotary file in your drill



DRIVE GEAR SETUP has 1:8 reduction ratio for easy hand operation or use with a low-horsepower motor



MOTOR RATED at 1/20 runs press at 5 ft. per minute with 9-tooth sprocket on motor and 12 on shaft

plate or aluminum sheet substituted for it.

Aluminum sheet is smooth-surfaced and may be used as is, but steel plate should be surface ground both sides to a uniform thickness by a firm specializing in this work. (Total cost locally would be about \$16 for either the prepared steel or the as-is aluminum.)

If metal is used on the bed, make some arrangement that will prevent the bed from falling out at either end of the press, as it could do considerable damage if dropped—particularly on your toe.

In the construction of the chase, the hollow-head setscrews installed along one side and one end provide the pressure needed to keep the printing form and furniture in place. Note that a strip of $\frac{1}{8} \times \frac{3}{4}$ -in. aluminum is placed between the screws and the blocks to take the thrust.

When using the press for lithography, the blanket cylinder will be installed in place of the steel printing roller. The height of the journal boxes in the slides will vary, depending on whether you're printing from plates or lithographic stone. This height must be determined from the situation at hand, and the space between the journal boxes and the springs filled

(Please turn to page 211)

Nailing tips to lengthen life of your new redwood siding

IF YOU'RE CONTEMPLATING an exterior remodeling job involving natural wood siding, such as redwood, it's important that you familiarize yourself with the special nailing procedures involved.

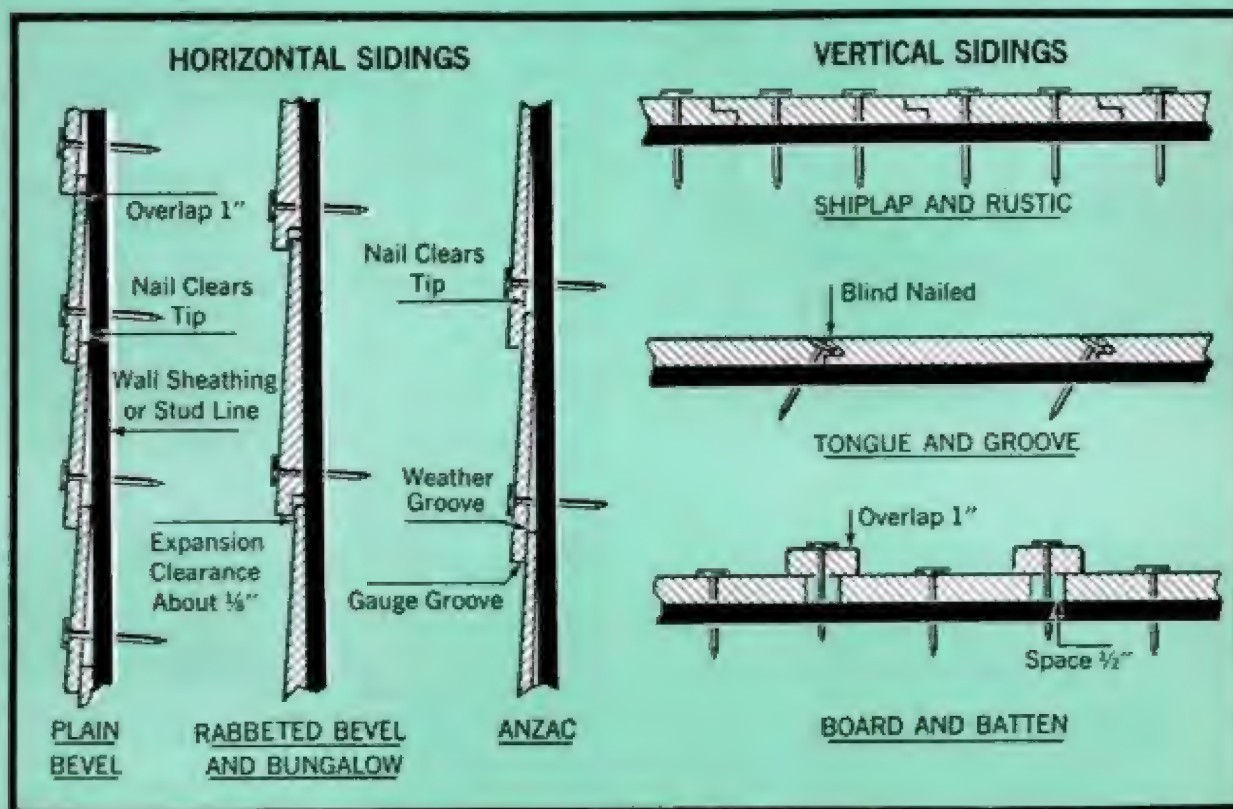
Never use a nail that will rust for exterior work (and this includes cement-coated nails). Stick with aluminum or stainless steel, if possible. Hot-dipped galvanized nails are sometimes satisfactory, but you may find that the galvanizing flakes off when you drive them, and if this happens, you're likely to get those ugly black corrosion stains.

As for the head design, there are four types commonly used with natural wood siding. A regular siding nail, which is the best choice for most work, has a slightly tapered head which can be either driven flush or countersunk. If you're definitely planning on countersinking, a casing-head nail is probably just as good.

Finishing nails are best for blind-nailing tongue-and-groove siding.

Shank design is also important. The standard smooth, round shank has sufficient holding power for most situations. If you're bothered by nails loosening, however, replace with spiral or annular-grooved type.

Even the point is important. Regular diamond-pointed nails are easy to drive and have excellent withdrawal resistance. On the other hand, a needle point or chisel point drives like a tiny wedge, and this is more likely to result in splitting. The Simpson Timber Co., one of the country's largest manufacturers of redwood siding, recommends the use of special siding nails having thin, grooved shanks for improved holding power and blunt points to avoid splitting. When nailing short lengths or ends, which are particularly vulnerable to splitting, predrill the holes before driving nails.



Build This White-Water Riverboat

It's a rugged, beefy craft designed to take the wildest rapids in stride, but tame enough to slip quietly into any shallow fishing inlet under oars. Best of all, you can build this dew-skimmer for \$100.

By CLINTON R. HULL

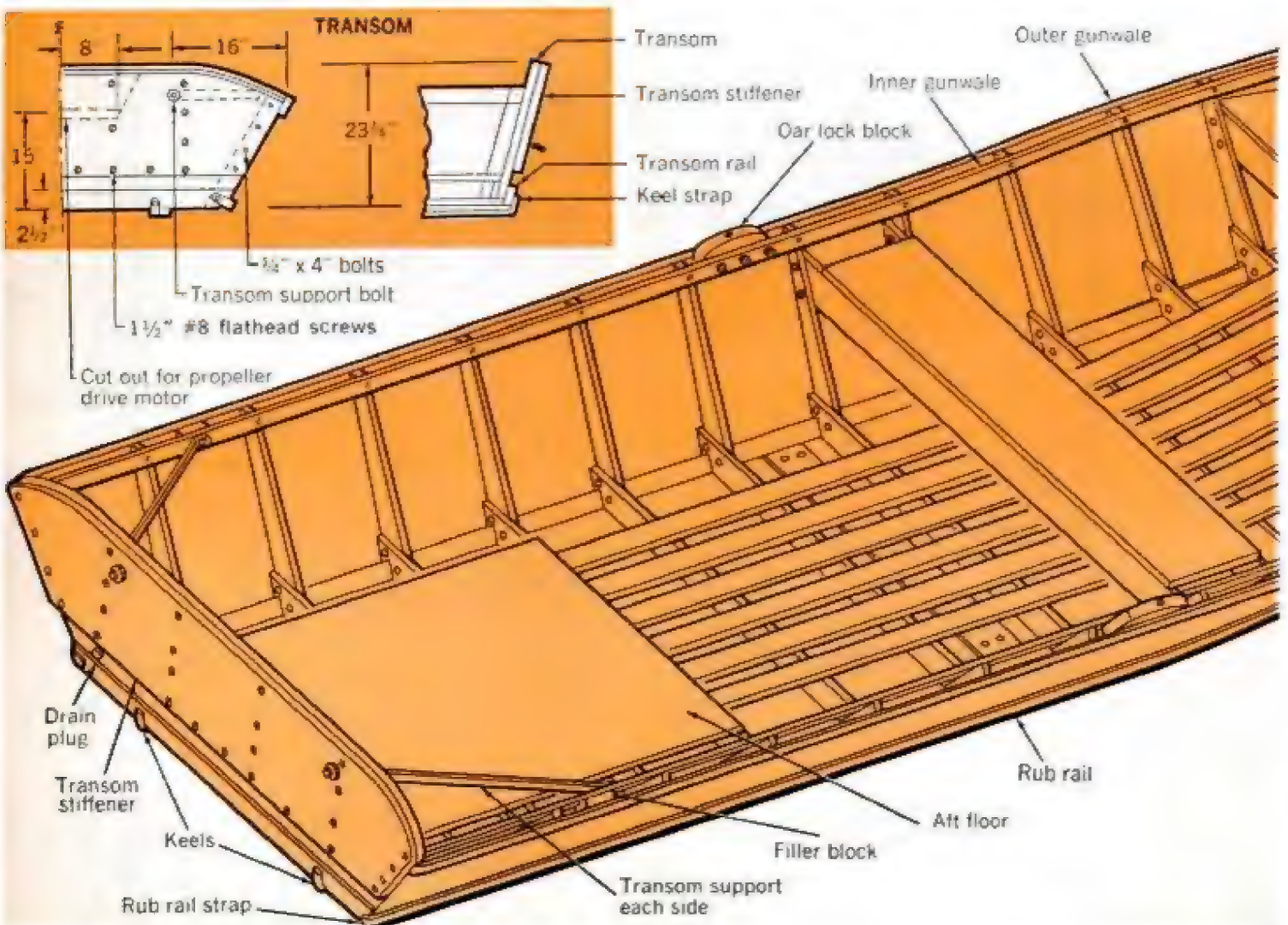
Technical Illustrations by Miles-Samuelson

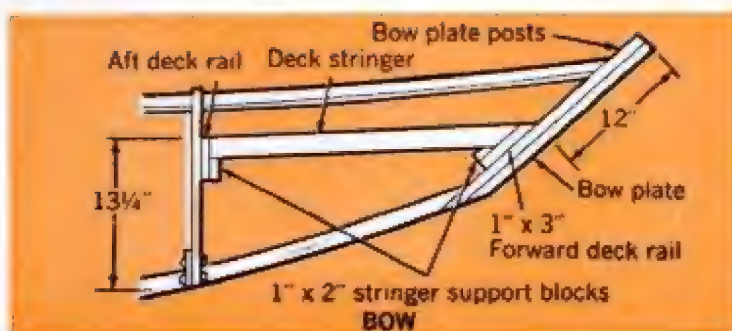
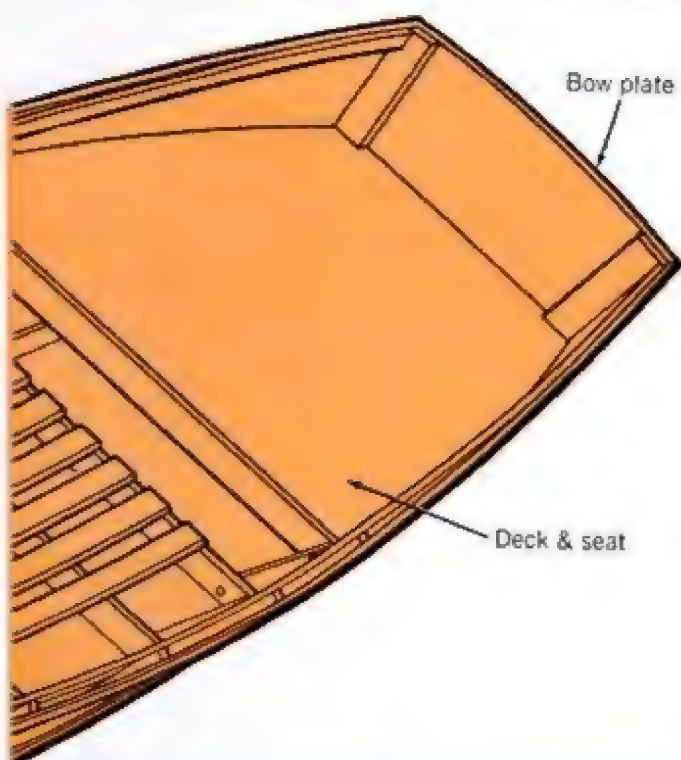
IT'S A REAL THOROUGHbred, this high-riding river sled. Evolved over a lifetime of white-water experience by famed riverman Glen Wooldridge. (*Conquering the Wild, White Rogue*, page 104, May '63 PM), it features a fast-rising bow which lifts easily over the largest riffles. This, combined with steeply flaring sides and a long flat after section, gives the boat tremendous lift, excellent maneuverabil-

ity and unbelievably shallow draft.

Glen's typical power rig is a mid-range outboard equipped with one of those husky jet-drive lower units from Outboard Jets. Such a setup gives the boat maximum shallow-water capability. I've been aboard when he's skimmed over 4-in.-deep riffles without touching bottom.

Best of all, it's very easily built and performs well with any outboard motor



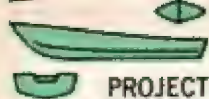


from 18 to 60 or more horses, depending upon the boat's size and the load carried. (The plans show an overall length of 16 ft. 10 in., but a 15-ft. 8-in. or 19-ft. 2-in. hull can be made by removing or adding one frame just ahead of the transom.) To assure perfect alignment, the use of a building jig is advisable, but this can be made of any inferior lumber, if straight.

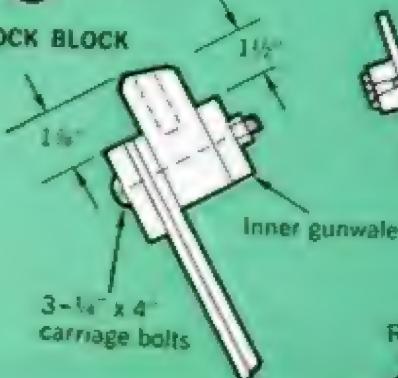
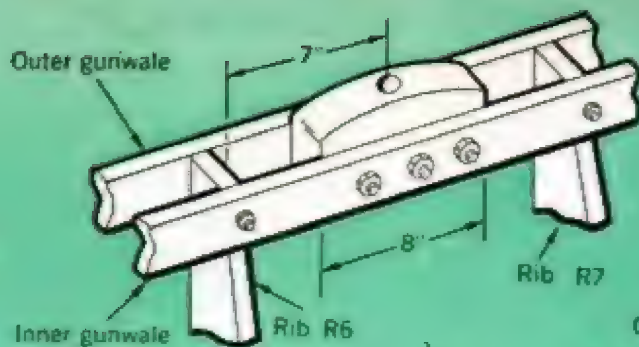
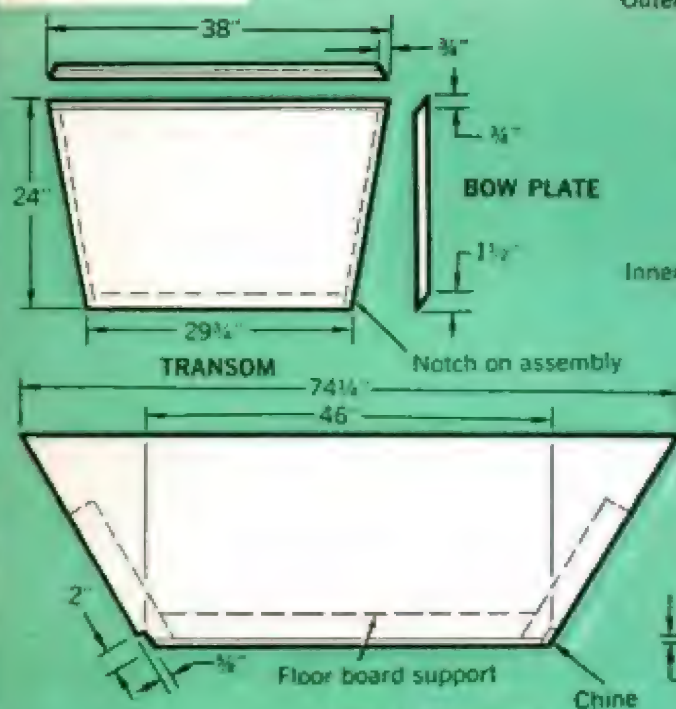
The template for laying out the frames can be made from $\frac{3}{8}$ -in. plywood or other second-grade material. The template layout dimensions give the placement of the five nail "pegs" to form the frames. Use small blocks to keep rib tips level.

Incidentally, except for the jig, all dimensions of the lumber used in the boat are *net*. Thus, the $\frac{3}{4}$ x3-in. frames and ribs are exactly that size. All nails should be galvanized, and bolts and screws either galvanized, cadmium-plated or bronzed. For salt-water use, bronze is recommended. In addition to these fastenings, water-resistant glue should be used on all joints.

Wood recommended for this boat is first-grade, straight-grained, clear spruce, Douglas fir or white cedar. All plywood should be exterior or marine grade and fiberglassing is definitely advisable. The

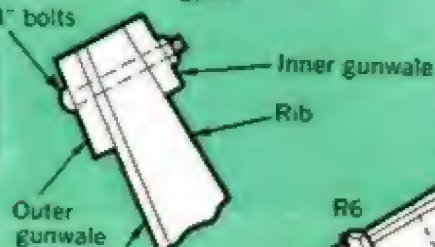


PROJECT



CUT FOLD TAPE

RIVER BOAT



1/4" plywood side

R

R2

Outer gunwale R1

22 1/4"

23"

Center line cord and nail

20"

10 1/2"

Rib riser

Rib base

Center line marked on each rib

Bevel for curve of sides toward bow

Rib R11 - 1/4"

R10 - 1/4"

R9 - 1/4"

R8 - 3/4"

SEAT FRAMING

Wedge, holds bottom frames (ribs) in place

Stop block

Jig leg

Rib positioner

Seat rails 3/4" x 4" ply.

Sill 1/2" x 3" ply.

158"

R11

R10

R9

R8

R7

R6

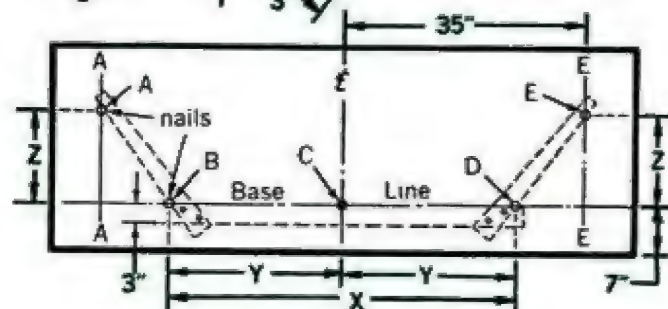
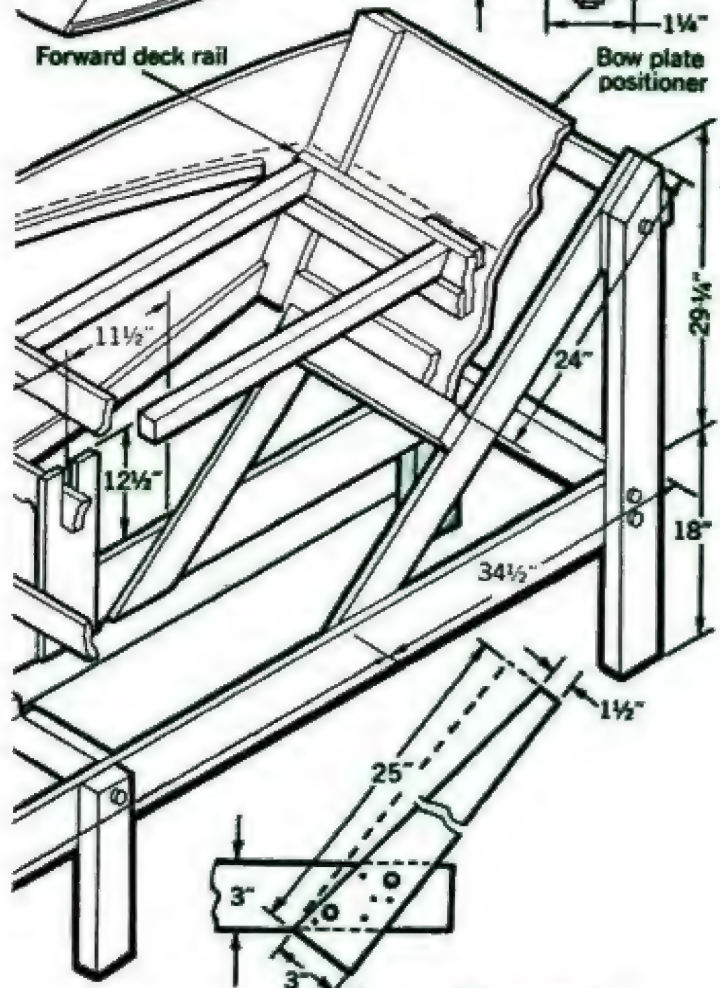
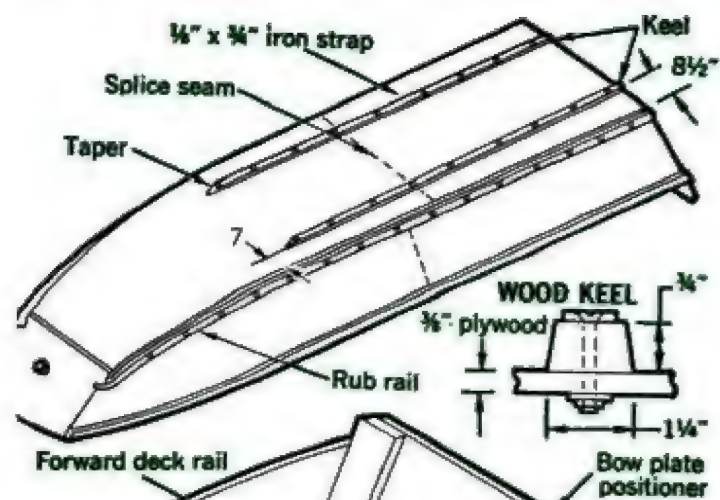
R5

R4

R3

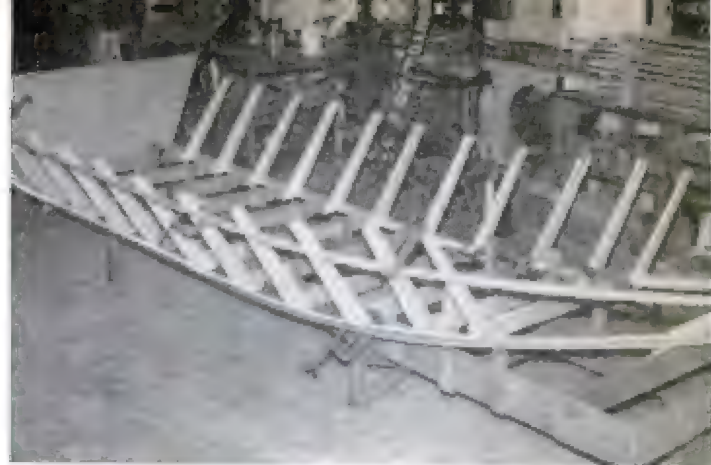
R2

R1



FRAME TEMPLATE ASSEMBLY

RIB TEMPLATE LAYOUT DIMENSIONS			
RIB NO.	DIM. X	DIM. Y	DIM. Z
R1 - R7	49 1/4"	24 1/4"	13 3/8"
R8	49 3/4"	24 1/4"	13 1/2"
R9	49"	24 1/2"	12 3/4"
R10	46 1/4"	23 1/4"	13 3/4"
R11	43 3/4"	21 1/4"	14 1/4"



HULL FRAMING is assembled right side up on building jig which can be made from any straight lumber

construction follows standard procedure—frames are assembled first and then mounted on the building jig, after which the longitudinal members are installed and finally, the planking.

You may have to soak the chine strips in order to get the proper bend. Just wrap them in an old blanket, towels or burlap, and pour on boiling water. Pour on more hot water after about 15 minutes and then let them set until nearly cool. Bending them will then be much easier.

If you plan to use a jet drive on the motor, leave the transom full height in the center. For a long-shaft, propeller-type lower unit, notch it to 20 in. and for a standard lower unit on the motor notch to 15 in. as shown. If you use both jet and propeller drives, notch it to suit the propeller motor, and either make a detachable transom piece to bolt in place or obtain one of Glen's transom brackets (\$19.50) for this purpose.

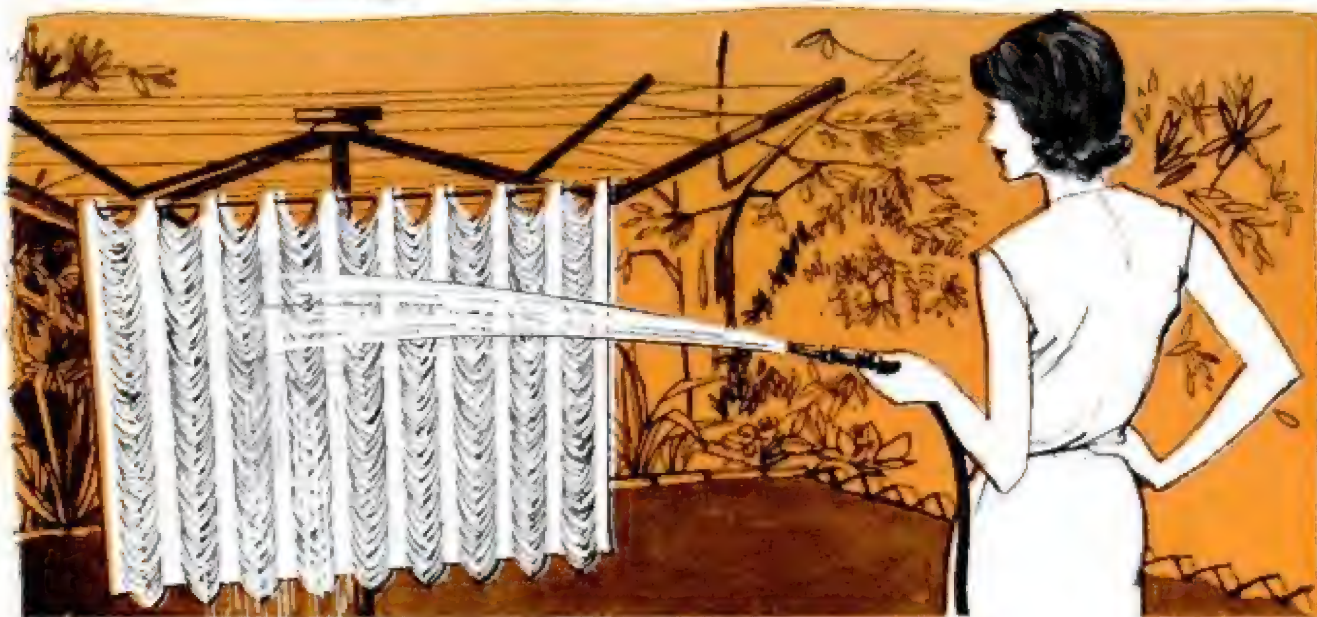
Cut and shape the keels as shown in the drawing. Then drill and countersink holes in the iron straps—one near each end and two between each pair of frames—to accept the heads of 3/16x1 1/2-in. flat-head machine screws. Bevel the front ends of the keels so the straps will fit over them smoothly, and bevel the tips of the straps to prevent snagging grass.

If you decide not to fiberglass the bottom, use glue and the 3/16-in. machine screws, nuts and washers to attach the keels. If fiberglass is used, the keels may be covered with it. Put the seams on the keel bottoms so the straps cover them, and apply a coat of the resin to the keel-to-boat-bottom joints to glue in place.

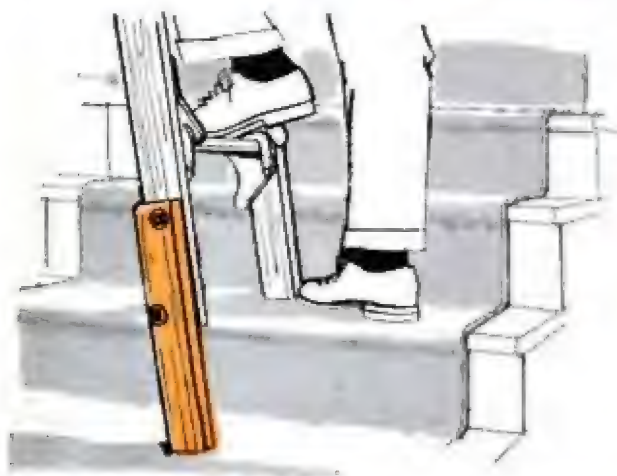
Make two transom supports by flattening 2 in. of the ends of two 7/8x30-in. pieces of electrical steel tubing and then

(Please turn to page 196)

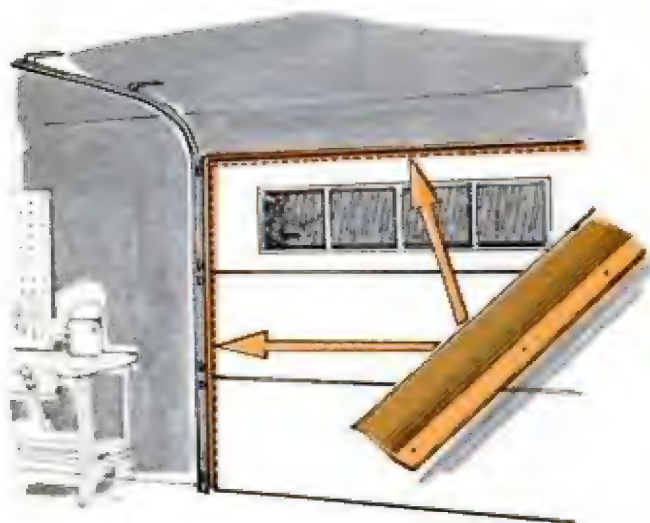
Solving home problems



EASY WAY TO RINSE fiberglass and drip-dry curtains which must be washed by hand is to hang them from the clothesline and spray them with the garden hose. It does a thorough job of removing all of the soapsuds



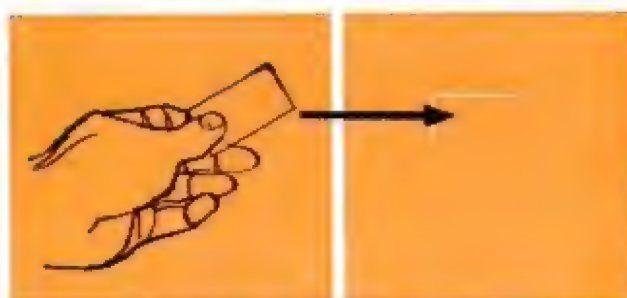
PEGLEG LADDER extension for use in stairwell bolts in place to lengthen one leg the height of the riser. You might also use C-clamps to attach the extension



STOP DRAFTS around folding garage doors by installing spring-bronze weatherstrip all around the jamb. It will press against the closed door and seal leaks



NO-SPILL HOLDER for a bottle of liquid shoe polish or dye can be made from the box it came in. Just make a bottle-shaped cutout in the front of the box



TO PATCH HOLES left when nails or picture hangers are removed from a wall, use a small piece cut from paint sample color card which matches the wall color

WHEN FASTENING A STIFF WIRE such as a clothesline, to a hook or other anchorage, first pass the wire through a metal washer. Then loop the wire around the hook, feed it back through the washer and finally secure the end by bending it back over the washer. The loop not only holds better than the old type, where the wire is merely wrapped around itself, but also simplifies taking up slack in the line. What's more, if you're using aluminum wire, there's less chance of its breaking when you undo the loop



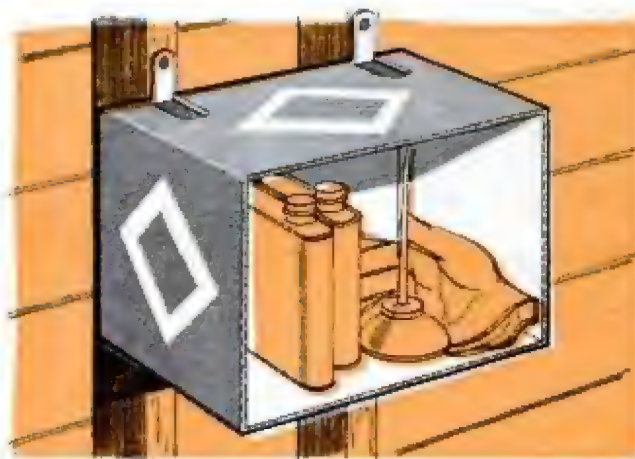
KEEP A PAPER CUP in the sewing-machine drawer to use as an extra pincushion as well as hold chalk, bobbins, thread, scissors and other sewing accessories



TO PREVENT the cork of a vacuum bottle from becoming stale, dry and permeated with odors, simply wrap cork with aluminum foil. It preserves the cork



YOU CAN MAKE a turntable for spray-painting small objects by covering top of an outdoor charcoal grill with newspaper and placing object in the center



CARTON SHELF hung from studs in your garage is a handy place to store oil cans, small tools and other necessities. Just cut tabs as shown and nail to studs



SPECIAL VASE to hold long-stemmed flowers is just a coffee can with holes punched in the plastic lid. To decorate it, cover can with foil or wallpaper

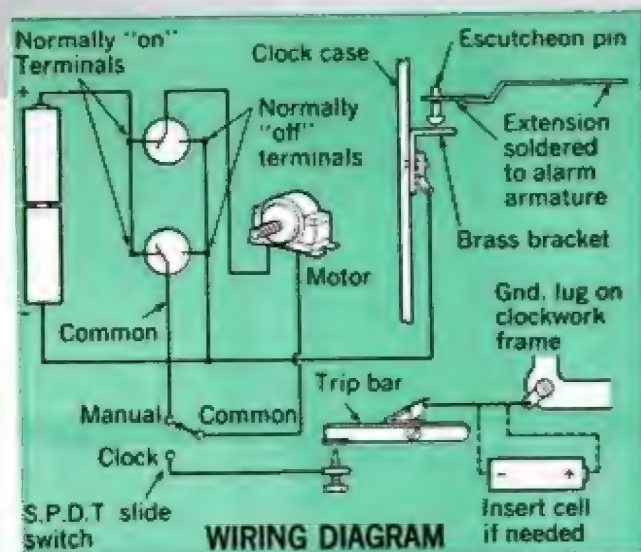


NO MORE STOOPING when painting a concrete floor if you tape the handle of the paint roller to a mop handle. When the job's done, just peel off the tape

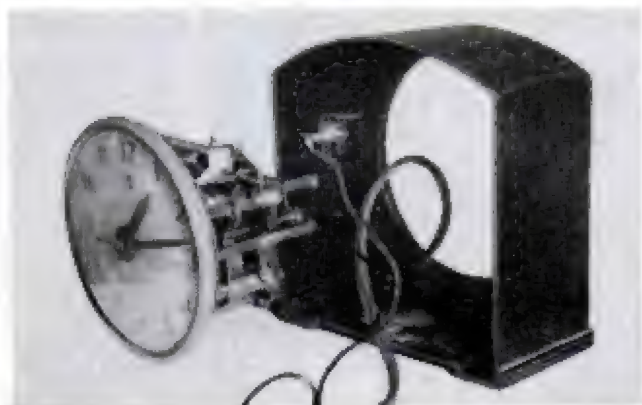
**SHOP
PROJECT**



WITH SLIDE SWITCH AT "CLOCK," tripping of clock's alarm turns the thermostat up and the furnace on



BRAIN OF BOOSTER is an electric alarm clock which is connected to it with low-voltage bell wire. Note brass angle bracket bolted to inside of case



Automatic Thermostat Booster



By HANK HILTON

Technical art by Technical Illustrators, Inc.

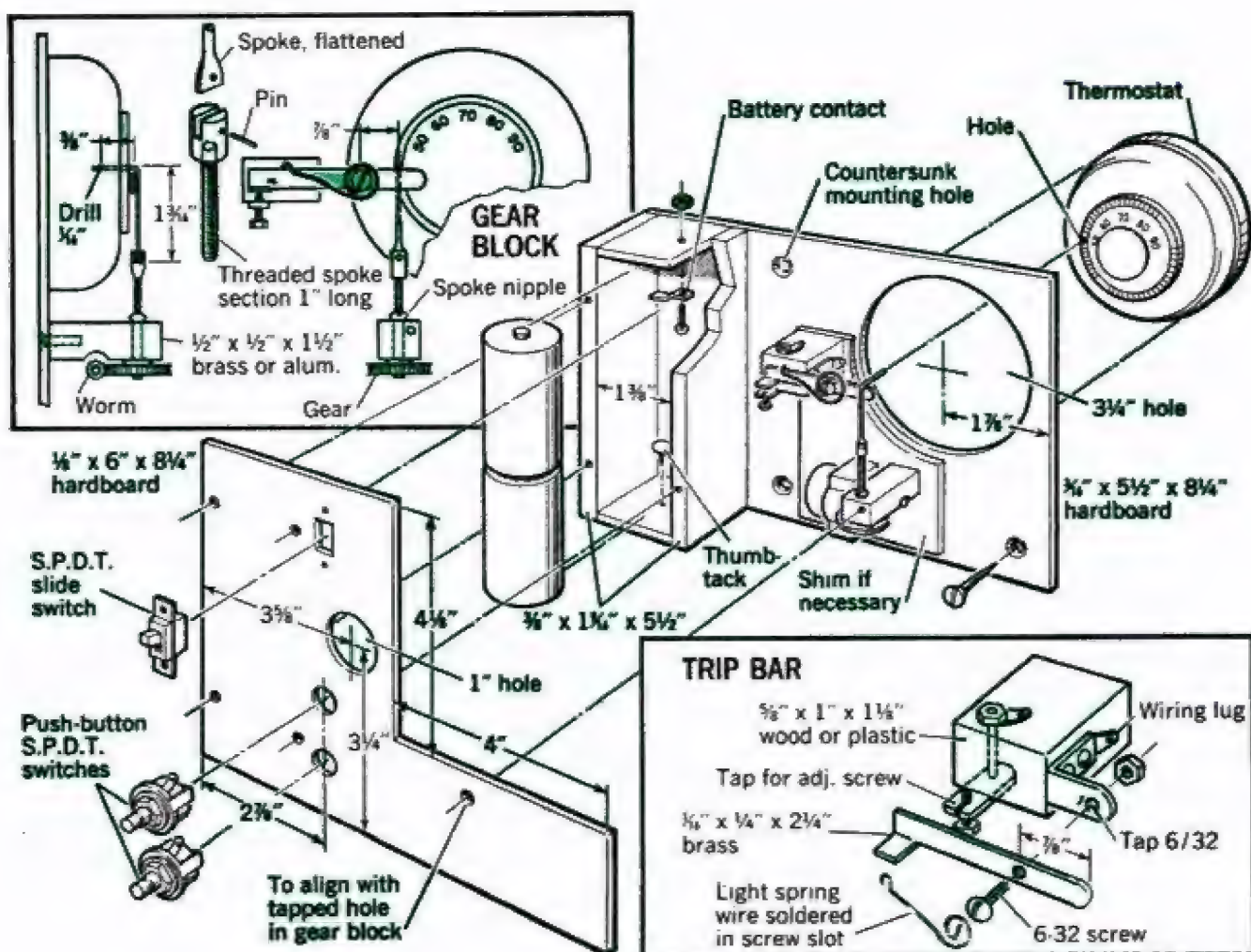
You'll wake to a cozy house once you "teach" this timer to turn up the heat while you sleep

TURNING BACK the thermostat when you retire for the night will save fuel to be sure. But not wanting to wake up to a chilly house, you can hardly set it less than 72° even though to set it back further would save still more on your heating bill.

However, you can do just that with this automatic thermostat control which lets you turn it back as much as you want, yet wake up to a cozy house without stirring from your bed.

Here's how it works: At night you set the thermostat where you please, say 60-65 or less, and flip a switch on the control which cuts in a clock circuit. At a preset time in the morning, a couple of hours before you have to get up, the clock triggers a motor that turns up the thermostat and kicks on the furnace. Thus while you're still "sawing it off," the house temperature gradually builds back up to a comfortable 76° or so, making it warm as toast when it's

(Please turn to page 182)



Woodworking Tricks

12 tricks of the trade that will put you in the class of an expert when it comes to doing it the simple way

By **WAYNE C. LECKEY**

Drawings by Phil Huy



SAWING OFF a small amount from the bottom of a door with a handsaw presents two problems: guiding the saw so it won't run out and keeping it from splintering the opposite side. Both problems are solved by clamping a scrap to the underside. With the strip backing the cut, the saw can't chip the veneer and it won't wander toward edge



IT TAKES a real steady hand and a good eye to saw a uniform bevel across a wide board or panel with a handsaw. However, there's nothing to it if you clamp a 2x4 scrap to the top of the work against which the saw blade can be rested as you guide it along the line of cut. The block must be positioned to suit angle being cut so it will support blade



HOW DO YOU RIG your bench saw to cut a perfect miter along the square edge of a wide plywood panel? First add a wood facing to the saw's fence, then with the blade tilted 45° and raised 3/4-in., ease the fence into the rotating blade enough to just bury teeth in the wood facing. Fence will support miter its full length as it passes the blade

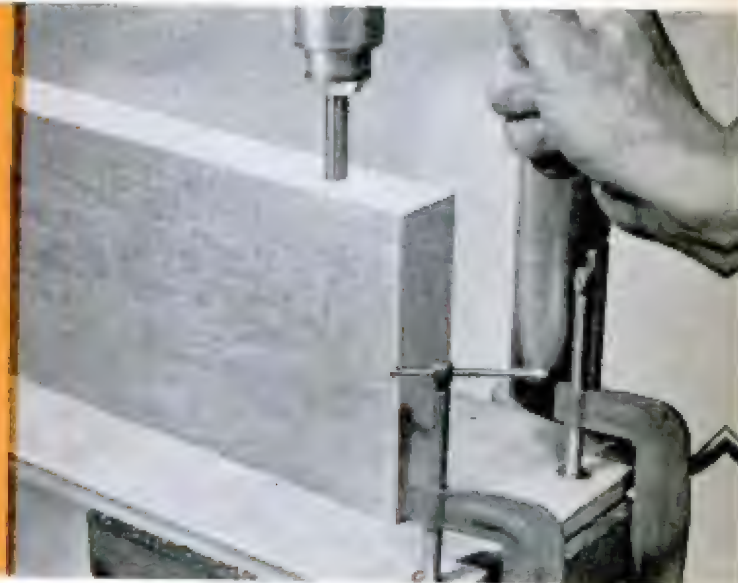
That Make You a Whiz!

YOU CAN BORE A HOLE from one side of a board and wind up with a splintered mess, or you can bore from both sides and have a hole as clean as a whistle.

This is just one of the little tricks that are the mark of a good craftsman and which comes as natural to the expert woodworker as blowing sawdust off the line.

The 12 simple techniques shown here and on the following pages, make tricky jobs simple, workmanship neater, and if you already know all 12, you're a whiz!

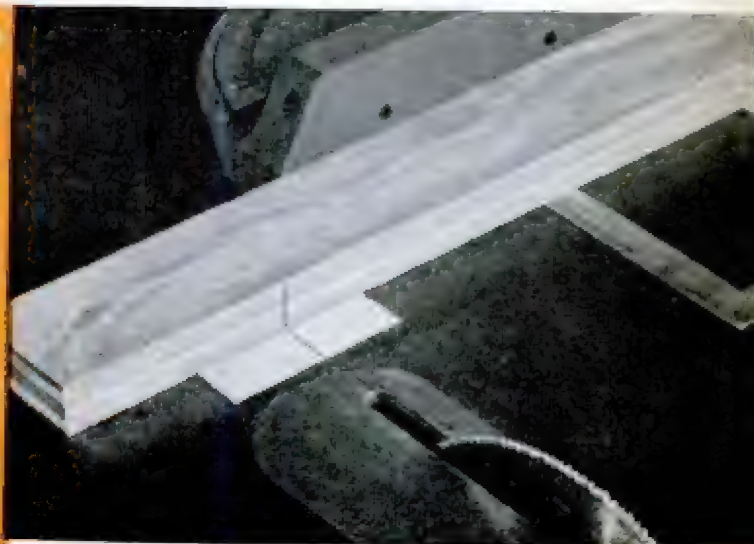
HOLES DRILLED edge-wise through a wide board will run true if you follow this trick: Fasten a wood table to the drill press and drill a hole in it for a same-size registering pin. Then, without disturbing the setup, drill a hole part way in the edge work and set the work over pin. Finish by drilling down from the top to meet the starting hole below.



SCREW POCKETS for fastening tabletops are neatly formed in the table's aprons with a simple jig consisting of a beveled 2x4 block clamped to the drill-press table. With the depth gauge set for the right depth, the work is merely held against the face of the slanting block. By cutting tangent to surface, the bit forms neat shouldered pocket for screw.



SAWING PRECISELY to line on a bench saw is assured every time if you have a guide line on the table by which you can align the cutting mark on the work. Stick a piece of white tape to the table in front of the blade and make a mark on it directly in line with the blade. You'll be right on target when you push the work toward the blur of the blade.





Bore until
spur pokes
through...



then complete
hole from opposite
side

BORING A HOLE from both sides of the work is not always possible, but when it is, you should remember this stunt for producing a clean-cut hole. Start boring from one side and keep going until the bit's spur pokes through. Then back it out, turn the board around and finish up the hole by boring to meet the first. You won't have splinters



Work tacked
to pattern

Router bit



Guide pin in wood
table same diameter
as router bit

Pattern

MASS PRODUCING identical cutouts, either pierced or in bas-relief, is easily done on the drill press with this simple jig and a master pattern. First clamp a board to the table. Then with a $\frac{1}{2}$ -in. router bit in the chuck, drill a hole in the wood table to take a guide pin. Then master pattern, tacked to the work, is guided by the pin to cut a duplicate

CUT
FOLD
TAPE

TOOL
KNOW-HOW



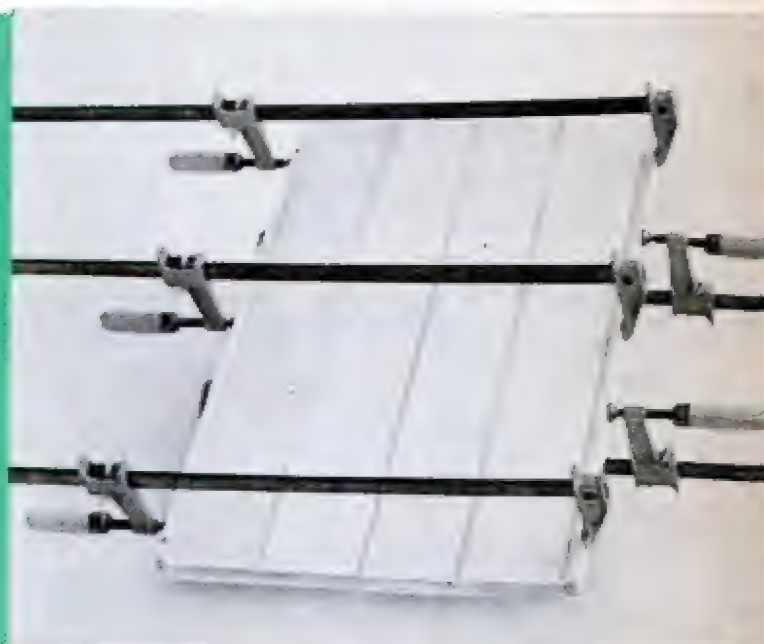
Nail set below
surface, then
chip glued back
down

CLEVER WAY of concealing nailheads is to bury them under a gouged-out chip. Use a woodcarving gouge to lift a chip from the surface and save it. Then drive and set the nail in the scooped recess and glue the chip back in place. When stained and finished, it's practically impossible to detect the glued-down chip concealing the nailhead

WHILE THERE ARE special "clothespin" clamps with swivel barbed jaws on the market for holding mitered joints when gluing, you can make your C-clamps do by gluing several triangular glue blocks along each side of the joint. Such clamping ears will hold sufficiently to draw joint tight; later, ears can be chipped off and surface smoothed



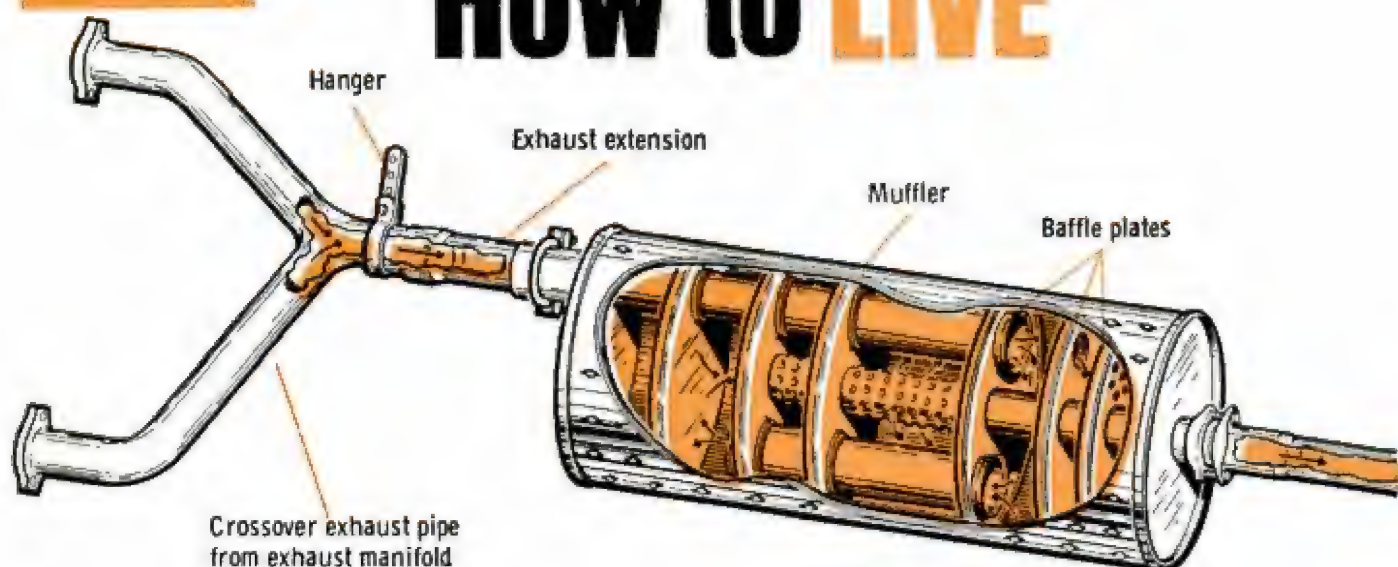
WHEN TABLETOPS and other wide panels are built up of random-width boards, there are two things to remember when gluing them together. First the heart grain of the boards should be assembled so it alternates from board to board. Second, the bar clamps should be placed on alternate sides. These two tricks prevent cupping, and top warping



BUTT JOINTS that are fastened together with metal corner irons can be drawn up tight if a cardboard shim is used when attaching them. Place the shim between one leg of the iron while the other is being screwed in place. The shim leaves a gap when removed, so screws can draw up the joint as they are tightened in the other leg of the corner iron



How to LIVE



with your muffler

By Morton J. Schultz

Illustrations by Miles-Samuelson

A leaky exhaust system is a grim companion in your car. If your system isn't in tip-top shape, you may not live to regret it. Learn what the danger signals are and how to fix them

MOST DRIVERS never give a thought to the car's exhaust system until, if they're lucky, it starts to roar, signifying a muffler breakdown. But a faulty exhaust system doesn't always produce noise, and it can let carbon monoxide (CO) leak imperceptibly inside the car through holes and gaps in the body. The only sure way to safeguard yourself against CO poisoning is by regular, visual examination of the entire exhaust system.

An exhaust system usually consists of six parts, sometimes eight. They are, from the engine rearward:

- **Exhaust pipe.** This attaches directly to the exhaust manifold of in-line engines or to either the manifolds or a crossover pipe on V-block engines. The crossover brings exhaust gases from both banks of cylinders into a common pipe on a single-

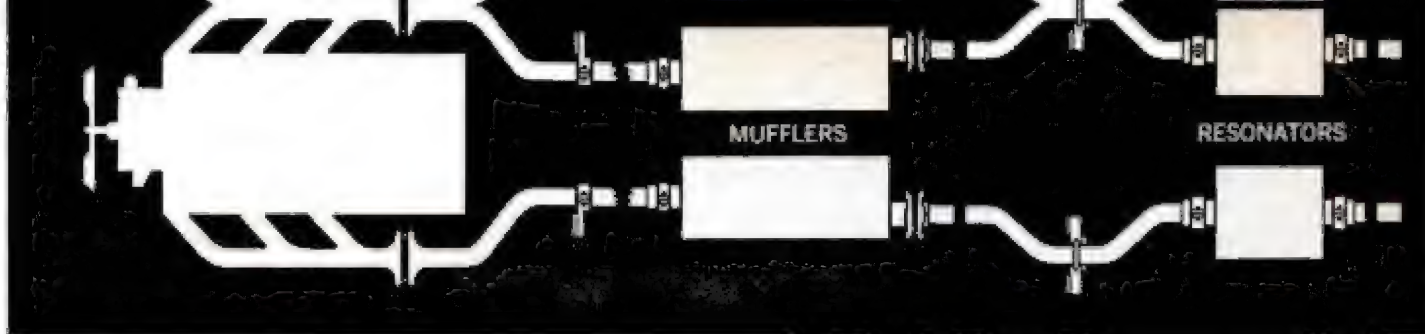
muffler car. Some dual-exhaust cars, however, use a crossover as an equalizer pipe to promote better sound control.

- **Exhaust extension.** This extends the exhaust pipe back to the muffler.

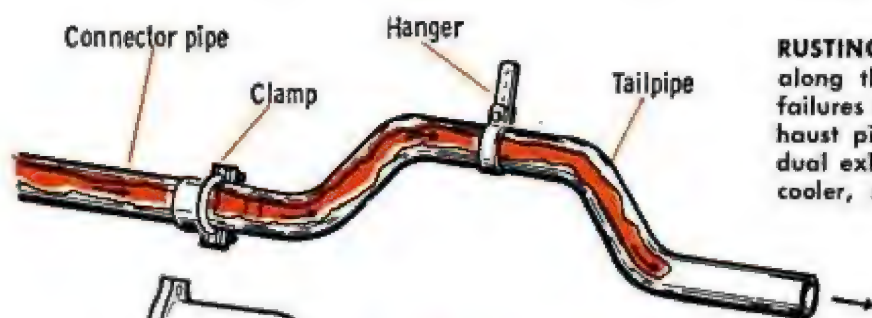
- **Resonator.** Not every car has this; usually cars with big engines do. It's merely a second muffler, smaller than the main one, designed to cut engine noise further. It may be placed here in the sequence or following the main muffler.

- **Muffler.** The heart of the exhaust system, its main job is to muffle engine noise by means of a series of chambers separated by baffle plates and perforated tubes.

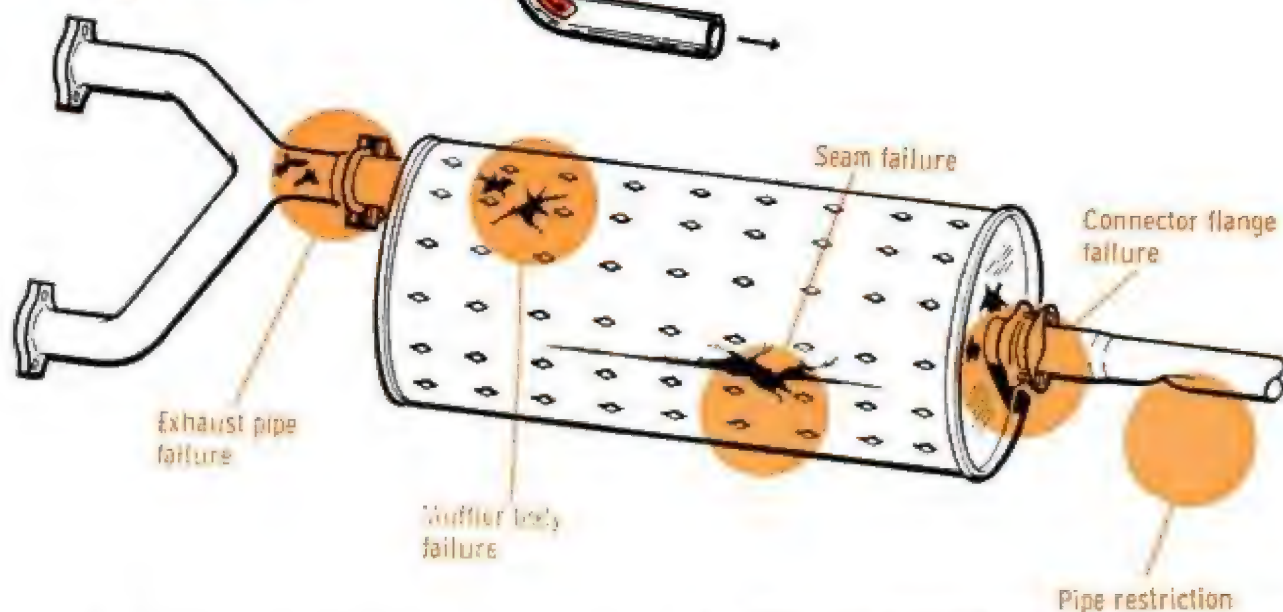
- **Connector pipe.** This is a second element your car may not have. It is the forward section of a two-piece tailpipe where a one-piece pipe is not practical.



EXPENSIVE CARS may have dual exhaust systems, such as this, with resonators added to improve the tone



RUSTING OUT may take place anywhere along the system, but the most common failures are on the muffler, then on the exhaust pipe. Short-hop driving and having dual exhausts (above), which tend to run cooler, may rust out your muffler sooner



- **Tailpipe.** This terminal part is attached either to the muffler or to the connector pipe.

- **Hangers.** These support the exhaust system. Made of a combination of metal and rubber or fabric, they permit a flexibility in the system to accommodate vehicle vibration and an expansion and contraction of system parts as they alternately heat and cool. A broken hanger can cause extensive damage by allowing exhaust system parts to bang around.

- **Clamps.** The system's parts are held together and sealed by them.

The muffler goes to pot faster than any other part of the exhaust system. Mechanics say that they will replace two mufflers on a particular car before they have to replace a tailpipe or exhaust pipe. And mufflers have no respect for youth. It is



OFTEN OVERLOOKED is the exhaust pipe-to-manifold flange. The presence of a white powder around the connection signifies a bad gasket or loose bolts

not uncommon to find one failing on a six-month-old car.

Mufflers usually show some form of damage when they fail, such as a hole in the body, a split seam or a break around an extension. These failures most often are from the inside out. The holes and split seams you see usually represent the end result—what happens after the muffler has had its insides eaten away.

Of course, road splash, especially in winter when road salt is spread, and banging by flying rocks, curbs and steep driveways could cause external damage. But the majority of muffler failure is due to a buildup of acid on the inside.

How to test for leaks. Conducting an exhaust-system test is easy, but it has to be done right. Instead of just a bend-down-and-peek-under examination, you should make a careful front-to-rear examination of *all* parts and connections *at least* every six months.

Again, proceeding in sequence:

- Check the exhaust-pipe-flange-to-exhaust-manifold connection. First, look for a white powder around the joint. Its presence means that the gasket is bad or that the bolts have loosened, letting fumes escape. Don't take chances—replace the gasket as well as tighten up.

Even if this telltale sign isn't present, when you start the engine later in this inspection, put your ear close to the flange. If you hear a popping sound, gas is leaking.

- Check the entire surface of the exhaust pipe, exhaust extension, muffler, tail-pipe and connector pipe (and resonator, if you have one). Look for cracks or holes. If rust flakes off as you run your hand over a part, make sure it's in good shape; for when you find rust flakes, it means the part is ready to go from the inside.

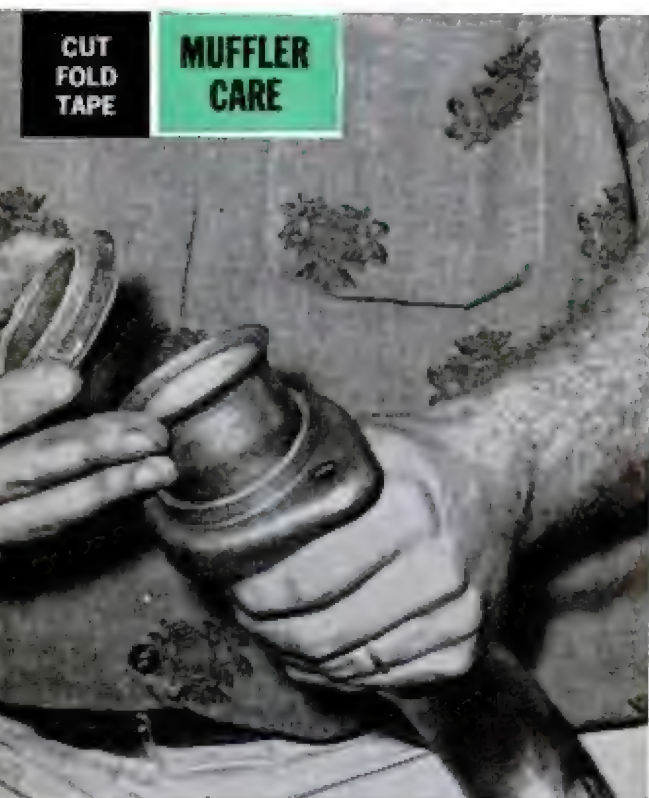
- Although the pipes may seem intact, they could be leaking or about to leak—you can't always see the defect. So, tap each part with a wrench or pliers. A good pipe gives a ringing sound; a bad one, a dull thud. You may even dent or pop a hole as you hit it, losing a few miles worth of use, but perhaps saving your life.

- Double check the muffler. Rap your fist against it. If you hear rattling, the baffles could be worn; but it's a gamble as to whether the muffler is actually leaking. For my money, though, I'd rather be safe and get a new one.

- Check all hangers and clamps to make sure they're not broken or loose. Vibration can loosen joints or bang parts against the chassis, either way causing leaks. Make sure there's adequate clearance of exhaust parts at the floor pan, frame, rear-axle housing, fuel tank and bumper.

- As a follow-up, even if everything seems "go," start the engine and look for leaks and listen for popping sounds at joints.

- Finally, the check that a lot of people, including the pros, miss: a restriction because of a loose baffle in the muffler, a kinked or collapsed exhaust extension, a



NEVER RE-USE AN OLD GASKET at the manifold-exhaust connection when replacing the exhaust pipe. For safety, a new gasket should always be installed

When the exhaust system is hot (over 212° F.), acid and vapor pass harmlessly out. But when it's cool, acid and vapor accumulate and begin to eat away.

Today's exhaust systems run "cold" more often than they do hot. The stop-and-go driving that most of us do so often doesn't allow the system to heat up and dissipate condensed acid. The fact that many people have two cars also contributes to the problem. Because each car is driven less, exhaust systems remain cold for longer periods. Furthermore, since dual exhausts run still cooler, they rust out faster than single exhausts.



AT EVERY INSPECTION or whenever a part is replaced, all clamps and hangers should be tightened to prevent destructive banging of parts. This one, on a Chevrolet tailpipe, is a combination hanger and clamp

plugged or impact-damaged tailpipe or a manifold heat-control valve that's stuck closed. You may get higher gasoline consumption, power loss at driving speeds and, on occasion, sufficient backpressure to cause stalling.

So, it's a good idea to take a vacuum-gauge reading at the intake manifold. Accelerate and close the throttle quickly. If the gauge's needle doesn't climb rapidly to 24 in., a restricted exhaust or a stuck manifold valve (if the car has one) *may* be at the source.

Since leaks can occur undetected, give yourself an extra bit of protection from poisoning by sealing off the passenger compartment. Check the underside of the body and the engine firewall. Throw back the rug on the trunk floor. Any rusted out areas and holes should be plugged with body sealer. In the trunk, the mat isn't air tight and neither is the rear seat fronting it. If there are parts that are really in bad shape, a piece of galvanized sheet metal should be installed.

Can you do exhaust-system-parts replacement yourself? Sure you can.

Should you do exhaust-system-parts replacement yourself? No, it doesn't pay, unless you have large blocks of spare time or some hefty tools. Let me give you some idea from personal experience.

Using hand tools, I suffered through four hours replacing the exhaust parts of a Corvette, when the job could have been

done by a professional with tools like a torch and power chisel in 30 minutes.

One national chain of muffler shops offers a guarantee on the parts and work for as long as you own the car, but with a service charge of \$3.75. Other shops guarantee on a prorated basis, much as is done with tires and batteries, the guaranteed portion decreasing with time. Dealers often guarantee against defective material or workmanship for 90 days or 4000 miles.

In short, then, shop around. The odds are that it's cheaper to have the professional do it. But it's up to you to know when a muffler needs replacing. ★★★

THE WARNING SIGNS OF CARBON MONOXIDE POISONING

Carbon monoxide usually gives some warning before it takes its toll, even though it's odorless, tasteless and colorless. Watch out for:

- Headache or head throbbing
- Roaring in the ears, apart from the muffler
- Nausea
- Rapid heart beat
- Impaired vision
- Drowsiness
- Confused state of mind

If you are affected with any of these symptoms, pull to the side of the road immediately and get out into the fresh air, breathing deeply. When you recover, don't take chances. Open all the windows and drive the car to a shop . . . pronto!



NEW FOR CAMERA BUFFS

BY LEONARD SAMUELS

1. The most versatile Super 8 Kodak Instamatic movie camera yet is the M8. It boasts four speeds and single frame, reflex viewing, automatic exposure control through the f/1.8 lens and 5:1 power zoom. Auxiliary battery case increases life, especially at 32 f.p.s. and when cold; under \$225. Eastman Kodak Co., 343 State St., Rochester, N. Y.

2. Camera does the running with the Yashinon-R 75-230-mm reflex zoom lens for SLRs. The f/4.5-f/22 lens is under \$180. Yashica, Inc., 50-17 Queens Blvd., Woodside, N. Y.

3. Interchangeability of lenses and accessories is hallmark of Miranda FV at \$159.95. This SLR has f/1.9 lens, speeds to 1/1000, depth-of-field preview, 3-yr. guarantee. Allied Impex Corp., 300 Park Ave. S., New York.

4. Get extra prints immediately with the Kali-Copier for the Polaroid Swinger. It sells for \$5.95. Also available are a self-timer and tripod bracket and a compartment case for the Swinger that holds camera, film and bulbs. Kalimar, Inc., 2644 Michigan Ave., St. Louis, Mo.

5. This is just one enlarger, the DoubLograM at \$59.95 less lens. It uses pantograph system for single-motion height and in-and-out adjustment and floor projection without moving stand. It has color head with choice of glassless carriers, 4-in. double condenser, threaded lensboard. Spiratone, Inc., 135-06 Northern Blvd., Flushing, N.Y.

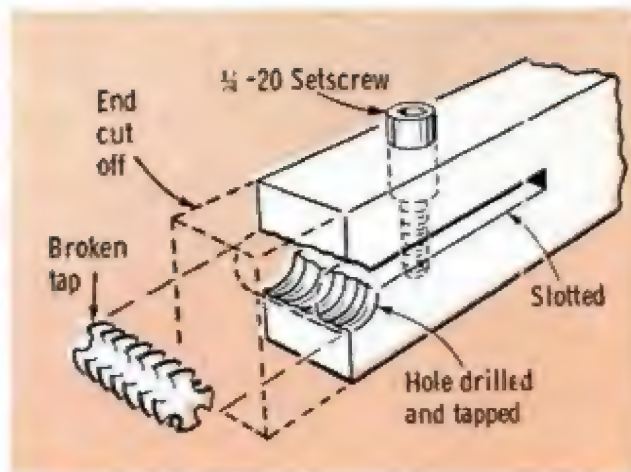
6. Professional effects for instant-loading, 8-mm movies is achieved with Fujica's Single-8 Z2 reflex zoom camera. It can be backwound, has variable shutter, 1/10-ft. reversing counter, 4:1 zoom, automatic/manual exposure control, remote control, single frame. Ehrenreich Photo-Optical Industries, 623 Stewart Ave., Garden City, N.Y.



Helpful reader hints to make shop work easier

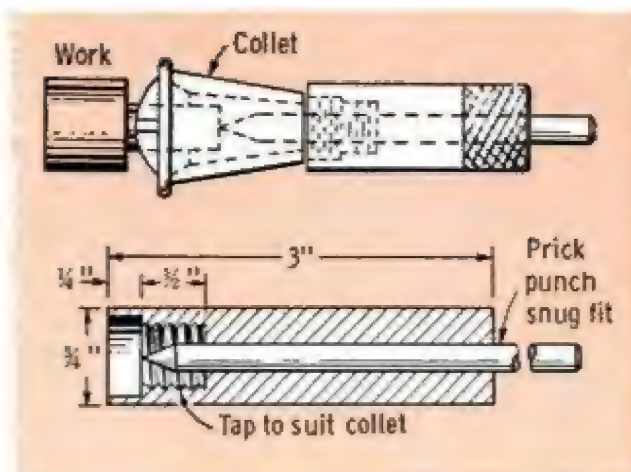
Tap chases lathe threads

A broken tap can be turned into a lathe thread chaser. Drill and thread a hole for the broken tap near one end of a cold-rolled-steel bar that fits the lathe's tool-post. Cut through the front of the hole so as to expose one row of tap teeth. Then, slot the bar from the hole back. For clamping, drill through the slot for a filister-head screw, tapping the lower hole and counterboring the upper one deep enough to seat the screw head.—*Peter Legon*



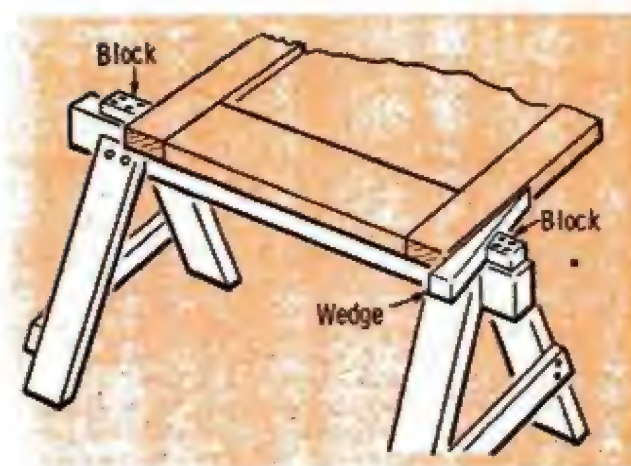
Punch guide centers rods

A punch guide for a collet will center rods quickly. Make a 4-in. prick punch and harden it. Drill lengthwise through a 3/4x3-in. cold-rolled rod for the punch; counterbore 3/4 in. deep and thread to match the collet. Counterbore again 1/4 in. for the collet body. To use, screw the collet into the guide, place the work in the jaws of the collet and tap the punch with a hammer. You can be sure of hitting perfect center every time.—*Peter Legon*



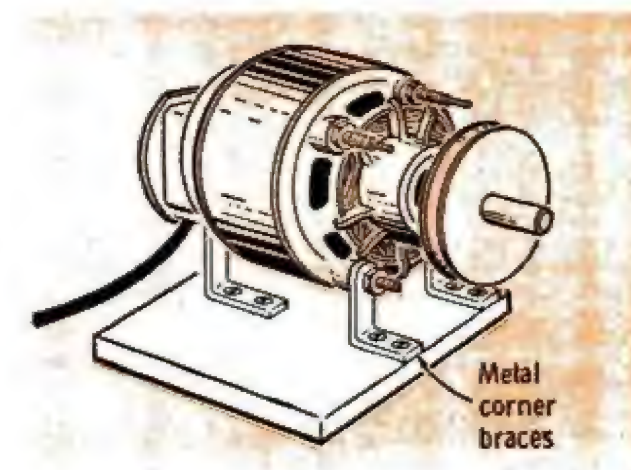
Sawhorses as bar clamps

Butt-jointed doors and window frames can be clamped for gluing on a pair of sawhorses. First, nail a pair of blocks to each sawhorse slightly further apart than the width of the work. Then, drive a wedge between one block and the work to force the joints together. You could also dowel one block for each and drill spaced holes in the top of each sawhorse to provide a wider range of adjustment to handle different size doors and frames.—*Albert Pippi*



Mounts for salvaged motors

The motors from old washers and dryers can be useful in the shop, but their lack of mounts or frames poses a problem. However, you can adapt four 1/2x2 1/2-in. inside steel corners as mounts. Cut and file one end of each so it will fit flush against the motor over the end bell studs. Screw the other end to a board for portable use. If you plan to use the motor in one location only, it can be mounted directly on your workbench. Either way, the mounts work perfectly.—*Oscar W. Johnston*





Sander Table For Metal Lathe

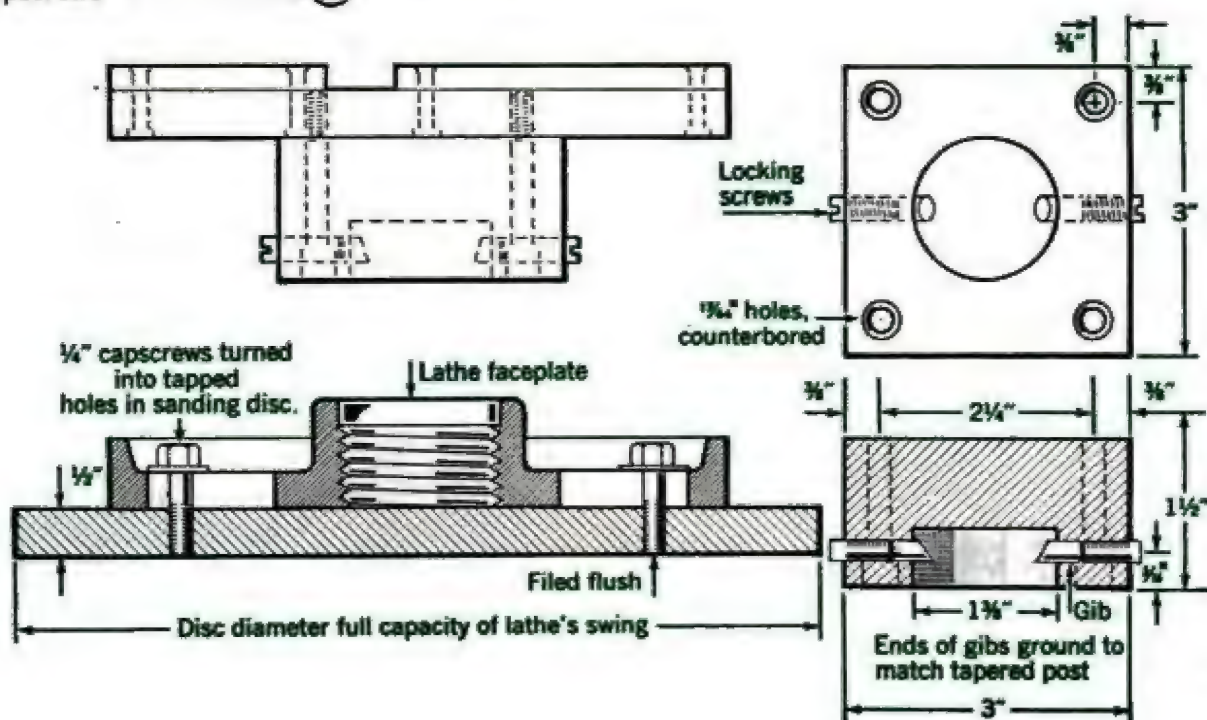
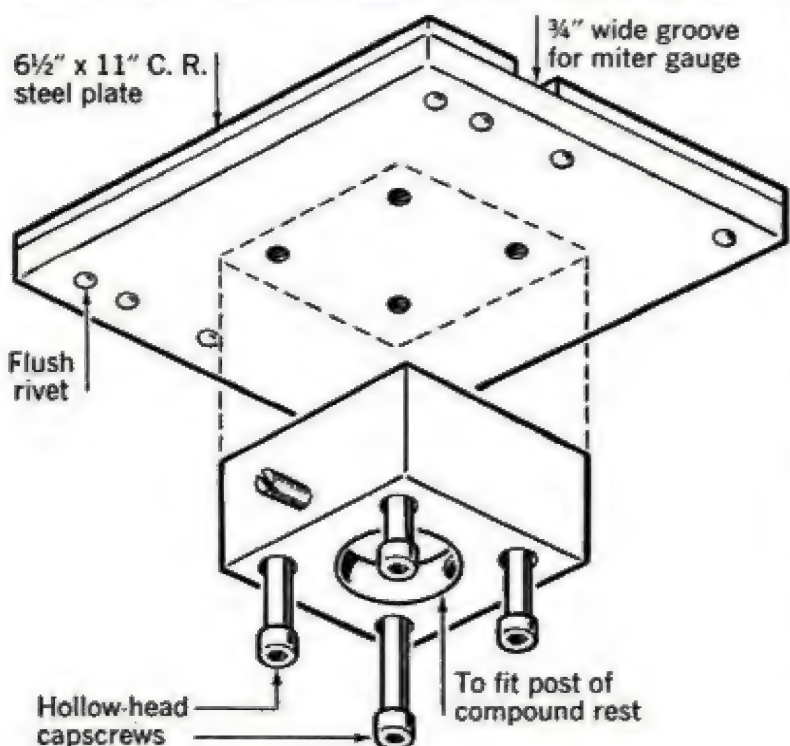
YOUR METAL-TURNING lathe can pinch hit as a fine disc sander when fitted with this handy shop-made accessory.

The entire unit is made from cold-rolled steel flats or heavy plate. Rough-cut the $\frac{1}{2}$ -in. disc on a bandsaw as large as the lathe will swing. Four capscrews fasten it to a faceplate for mounting on the lathe's spindle. In this position, turn its edge and face to run dead true.

Then, bore a block of mild-steel bar stock for the table standard to fit the dovetail post of the lathe's compound rest. Drill crosswise for the anchoring screws, and drill and countersink for hollow-head capscrews to bolt it to the sander table.

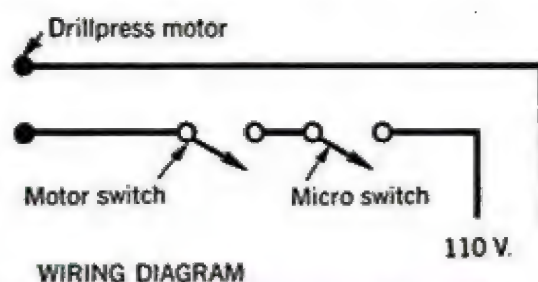
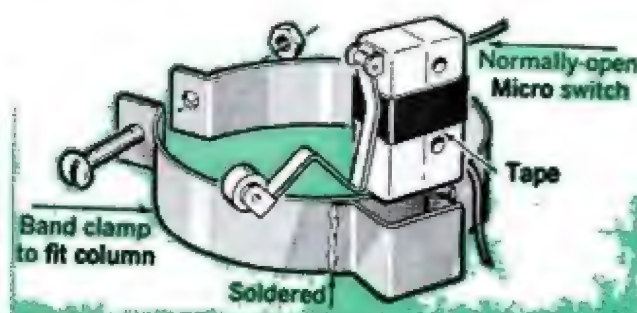
The table top is three pieces of steel plate riveted together. The one-piece bottom is $\frac{1}{2}$ -in. stock and the two top pieces are $\frac{3}{8}$ in. These two must be cut to fit flush with the bottom and parallel to the disc, while allowing a $\frac{3}{4}$ -in. groove for your saw miter gauge.

—C. W. Woodson



'Deadman switch' prevents injury by flying chuck key

If it hasn't happened to you, you're lucky. But workshopers have been known to leave the key in the drill-press chuck and have it fly out when the motor has been turned on. This "deadman" key holder prevents turning on the drill until the key is hung on its hook. As the detail shows, the holder is made from a Micro Switch of the type which has a roller arm. Bend the arm to form a hook for the key and wire the switch to serve as a second switch. Attach holder to the drill-press column with tape or, for more permanency, with a band clamp.—Joseph Braunstein



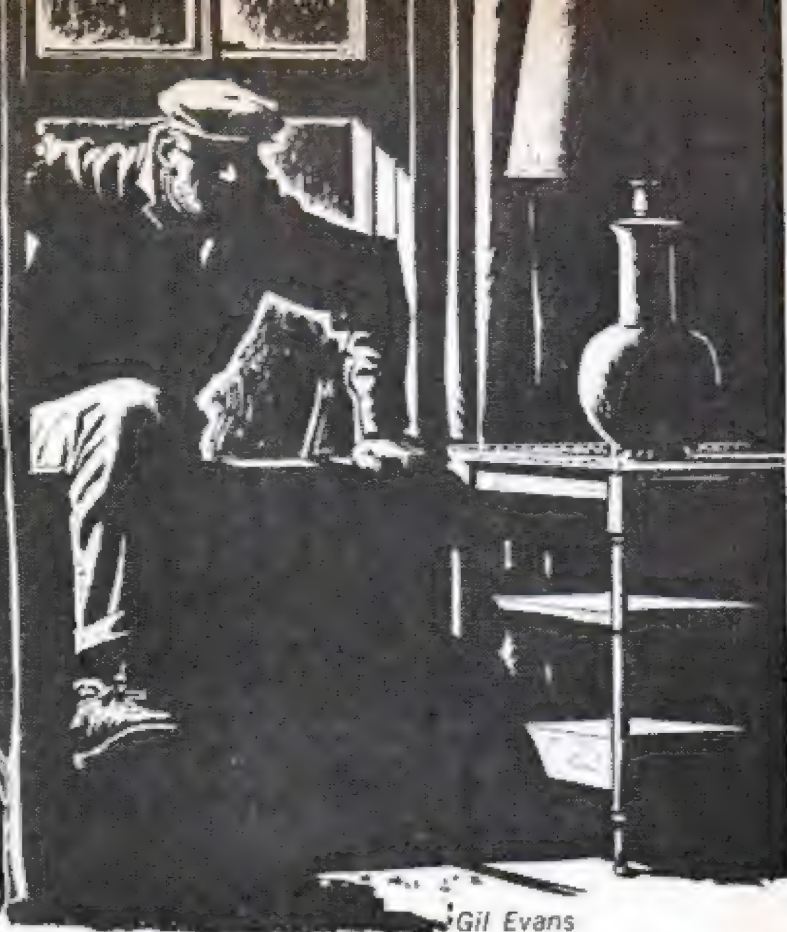
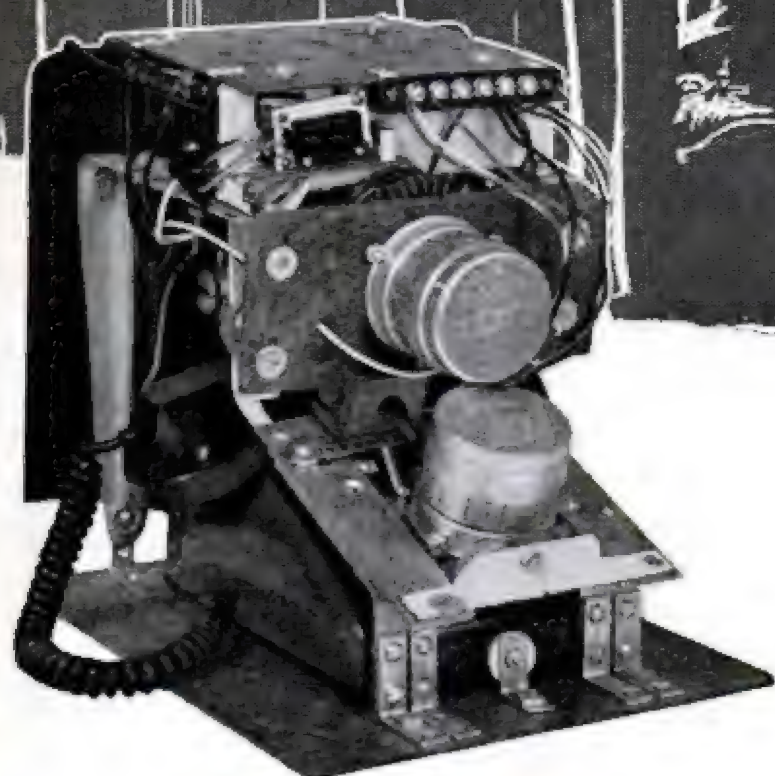
There could be more than one setscrew in the pulley

While back-to-back setscrews in a pulley give double assurance that it won't loosen on its shaft, it still happens. But aside from this, the fact that there may be a second "hidden" setscrew in a pulley can be the cause of a pulley loosening repeatedly after being tightened.

This happened to me recently when the pulley on the washing-machine pump became loose on its shaft. It was only after I discovered that there was a second setscrew under the top one that I was able to tighten the pulley for keeps. Back out the top one just to be sure.—L. C. Wayne

NEXT MONTH IN SHOP AND CRAFTS

- **HOW TO GET STARTED IN METAL TURNING.** If you'd like to branch out from wood-working and trying your hand at metal turning, you'll be eager to learn the basics as outlined in the first of a three-part article beginning next month. In this first of the series you'll be shown how to set up work between centers, as well as mount it for faceplate turning
- **BUILDING THE STILETTO.** This may be the very boat for you. It's a 16-foot, high-performance runabout with sleek SK streamlining and a super-speed bottom. You can build this flat-bottom hull, which is ideal as a ski boat, from complete plans in the January issue, or from a precut frame kit available from the builder.
- **THE HANG OF HANGING SLIDING DOORS.** Treats all types—multifold, bifold and bypassing—whether you're fitting one to a wardrobe closet, storage cabinet or patio doorway. Takes you through the steps of installing tracks and hardware of all three types
- **HALF-PINT U-BOAT IN A BOTTLE.** Sure to stump your friends as to how it was done, this intriguing novelty makes a never-ending conversation piece for your den. It's a model of the USS *Flasher*, the American sub that sank the greatest tonnage of enemy shipping in World War II. Step-by-step photos show you exactly how it's done.



Gil Evans

SMALL MICRO SWITCH tripped by a burglar opening a window or a door sets off a chain of events of which he is unaware and which will inform against him. One solenoid lifts the telephone receiver, another positions a dialing motor, and the call is out!

Phone tattles on burglars

You can build this ingenious alarm protection system—called 'Phone-a-larm' by its inventor—by using a unique 'program-drum' to dial any number

By W. R. KINGEN

Technical art by Technical Illustrators, Inc.

ARE YOU PLAGUED BY BREAK-INS at a vacation home, business office or any other building you have to keep watch over?

You can be warned of intruders instantly with a burglar alarm that I developed, utilizing existing telephone service. After a rash of burglaries, I installed it in a school where I am principal.

Several weeks of spare-time efforts resulted in a device I call the *Phone-a-larm*. "Phone an alarm" is exactly what the device does when set in motion by the opening of a door or window. When tripped by a concealed switch, the Phone-a-larm raises the telephone receiver, dials my home telephone number, permits the number to ring about three times, then

drops the receiver to break the circuit for a few seconds. It then repeats the entire 60-second process.

This circuit-breaking feature permits me to use my home telephone to call the police. It also increases chances of the alarm getting through if it receives an initial busy signal from my number. A circuit timer cuts off the entire device after a desired number of dialing-ringing cycles. Cost of building the unit was less than \$50.

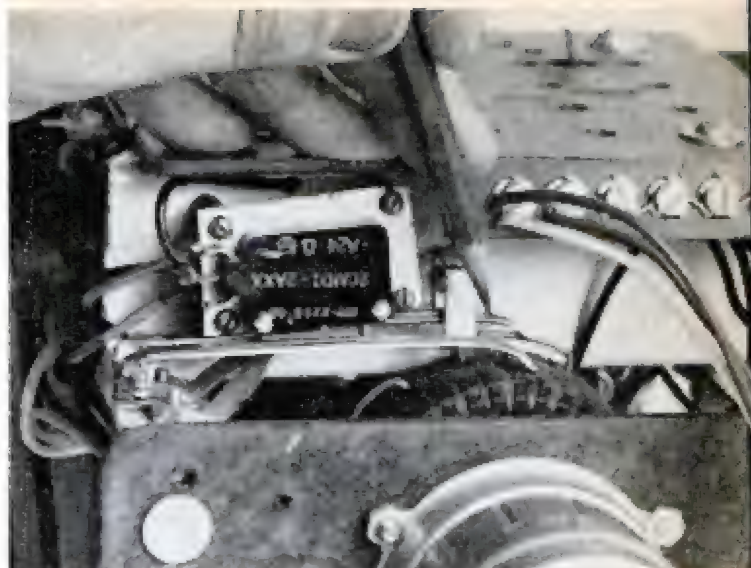
The Phone-a-larm in no way alters the telephone instrument, either mechanically or electrically. A metal band is attached to the receiver for lifting purposes; otherwise, the telephone set is merely clamped into working position. If the telephone is concealed in a relatively soundproof box, the burglar has no way of knowing he has called in the fact that he is engaged in a job.

Start construction by cutting out four hardboard panels, following the exploded-view drawing. Then bolt the two shelf-bracket anchor angles in place.

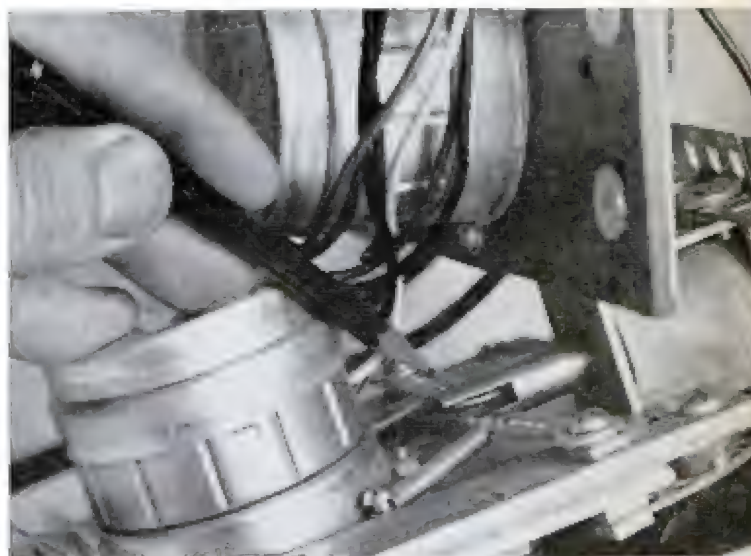
For the dialing motor assembly, bend two of the 6-in. mending plates at an approximate 60° angle with the shorter or vertical arm being 2¼ in. long and the angled arm 3¾ in. long. (Here you must gauge the above angle to correspond with the angle represented by the slanted dialing portion of your telephone set). Pressed cardboard or other suitable material is placed and bolted between the upper straight mending plate and the lower angled plate to form a groove for a plastic slide for motor M2.

Drill the extending 1 in. of top plate and attach strap-iron or aluminum-bar supporting ties, shaped and dimensioned approximately as shown. This attachment serves to connect the dialing motor assembly with the top portion of the total assembly; one bolt each side is sufficient.

Mount the 30-rpm dialing motor M2 on a clear plastic slide after first drilling a hole for the motor shaft. Drill a hole in the motor shaft and slip a rubber stopper onto the shaft after the small end has been cut to approximately a ¾-in. dia.; the large end of No. 3 stopper should be of 1-in. dia. Be sure the hole of the stopper is well centered. Push a ¾-in. wire brad through the stopper and shaft to serve as a pin; recess the brad head slightly and the dialing roller will then be



TRIPPER FINGER indicated by pencil closes switch S3 by riding on clip in program drum's dialing track. Visible above other tripper finger is plunger of S2



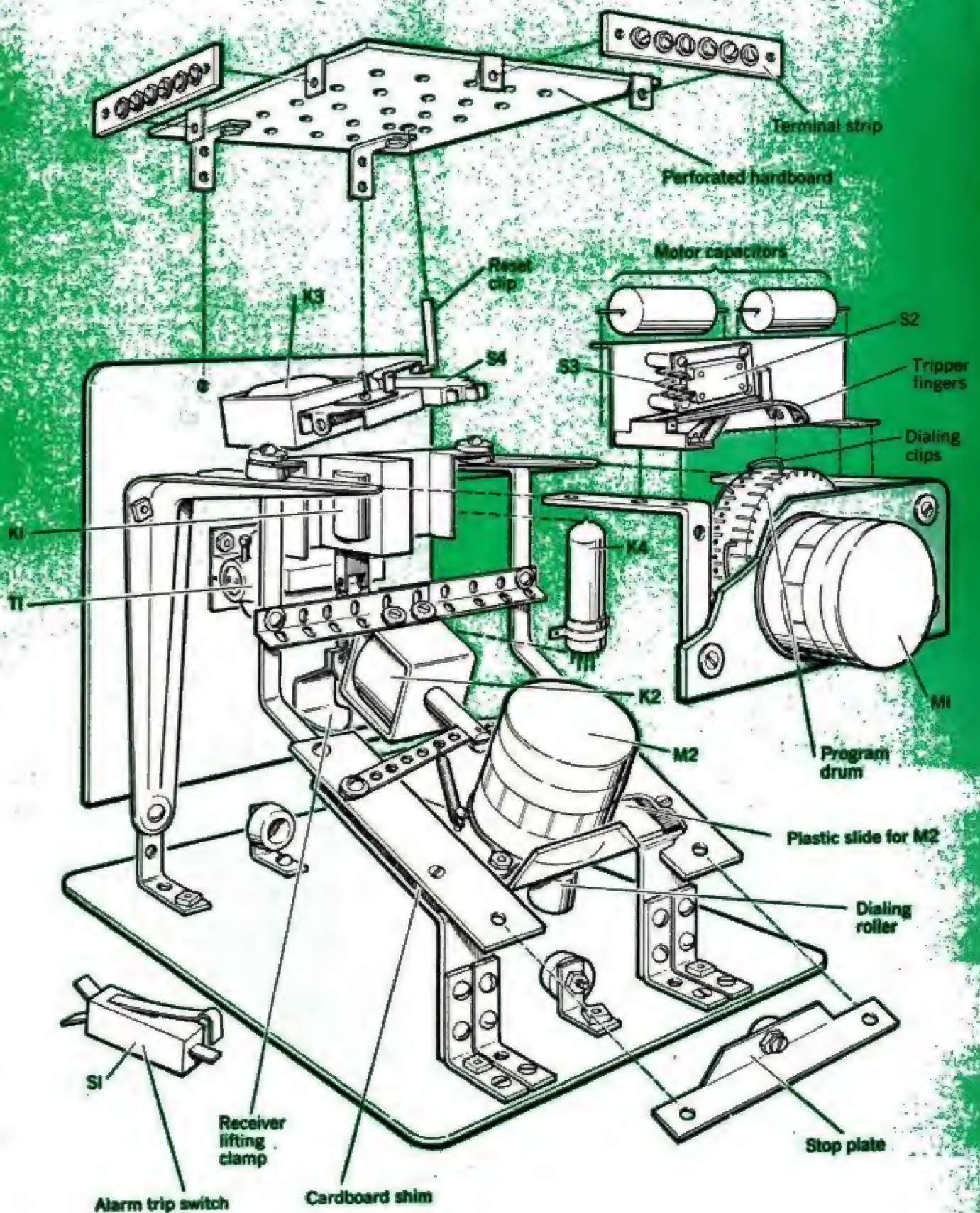
PLUNGER OF SOLENOID K2 pulls plastic slide, where dialing motor M2 is mounted, into position for dialing. Rubber washer and springs improve slide action

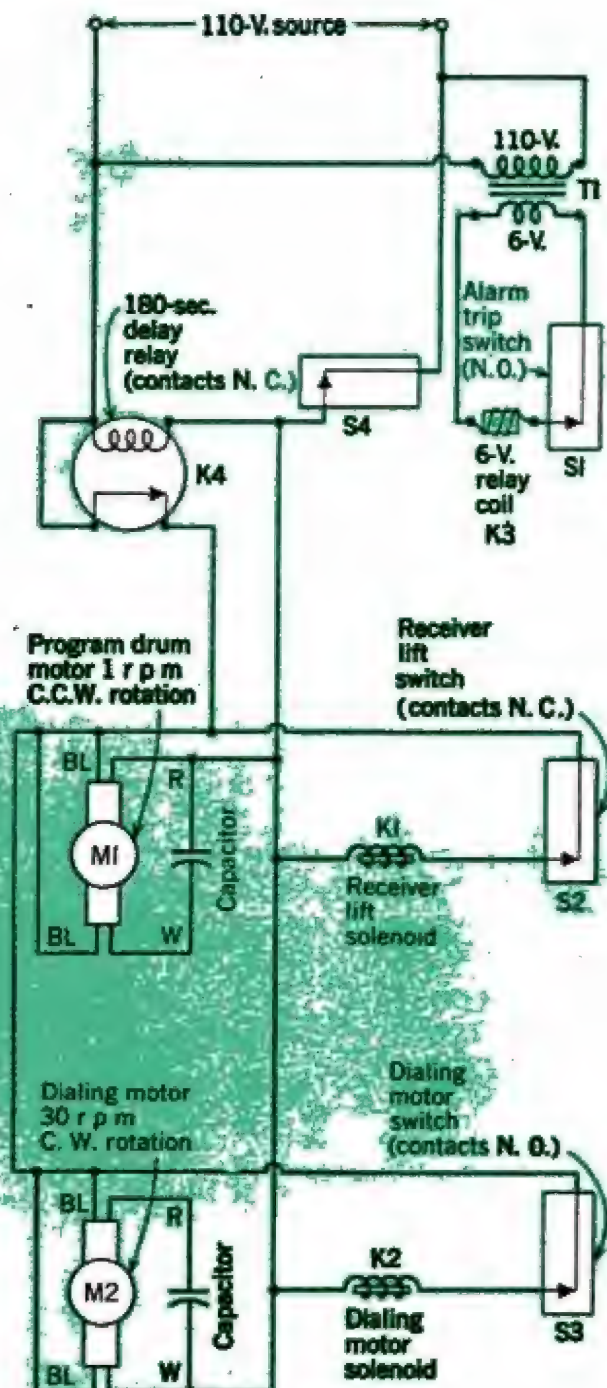


RUBBER STOPPER on the shaft of dialing motor M2 contacts the telephone dial to dial successively the individual numbers in the number you program

ELECTRONICS PROJECT PHONE-A-LARM

Pictorial diagram





Schematic diagram

ALARM OPERATION is shown in schematic above. S1 is tripped causing K3 plunger to pull in and close S4. Power is applied to M1, and program drum actuates switches S2 and S3 for receiver lifting and telephone dialing. Relay K4 shuts down the system

EXPLODED VIEW (left) shows details. Not visible is sheet-metal lever attached to body of S4 and plunger of K3. K3 plunger pulls in, lever depresses pin-plunger of S4, and reset clip drops over lever to hold this actuating switch closed. Lift to reset

ready. Slip motor M2 and the plastic slide into the groove of the slide assembly and bolt the sheet-metal angle, with the rubber screw bumper into place.

Position the telephone set in a trial working position. Push the telephone dial end under the motor slide assembly until the extreme lower rim of the dial is approximately $\frac{1}{8}$ in. from the rubber roller. The lower end of the rubber roller must be at least $\frac{1}{8}$ in. above the telephone case. If these conditions are not met, adjust the anchor angles by redrilling holes or elongating existing ones.

This is a good time to assemble the front and rear-screw rubber bumpers on the 1-in. angles; place them in position and mark for drilling. Groove the base panel for the rear bumper bolt to permit a sliding adjustment. With the phone clamped in position, complete adjustment of supporting angles.

Prepare the sheet-metal angle to which solenoid K2 is mounted. Center, drill and bolt the solenoid to underside of angle. Use the bolts furnished, or longer ones if necessary, and slip rubber washers or shims between the angle and solenoid frame. Use the two prethreaded frame holes at the rear of the top portion of the solenoid.

Now position the angle and solenoid against the vertical portion of support ties until the plunger clears the top of the plastic slide by $\frac{1}{4}$ in; mark position of the

(Please turn to page 206)

PARTS LIST

- K1—Guardian Type 12, 115-v.a.c. solenoid, continuous duty, 1" max. stroke, 22-oz. lift
- K2—Guardian Type 2, 115-v.a.c. solenoid, continuous duty, $\frac{7}{8}$ " max. stroke, 10½-oz. lift
- K3—Guardian Type 11, 6-v.d.c. solenoid, continuous-duty, 1" max. stroke, 26-oz. lift
- K4—Amperite Type 115C180, 180-sec. normally closed delay relay
- M1, M2—Hurst CA Series, reversible synchronous motors; 1 and 30 rpm, respectively
- S1—Acro Type 2CMD1-2AXX-A24, snap-action flat-leaf actuating switch, 3-amp. rating, 115-v.a.c.
- S2, S3—Acro Type 1CMD1-2AXX, snap-action pin-plunger actuating switch, 3-amp. rating, 115-v.a.c.
- S4—Acro Type 1MD1-1A, snap-action, pin plunger actuating switch
- T1—115 v.a.c. to 6-v.a.c. power transformer

Hardware—2 shelf brackets, 6x8"; 6 angle irons, $\frac{1}{2}$ x1x1" 6 angle irons, $\frac{1}{2}$ x1½x1½"; 2 angle irons, $\frac{3}{4}$ x3x3"; 4 flat mending irons, $\frac{1}{4}$ x1½x6"; strap iron, $\frac{1}{4}$ x½x16" or aluminum bar, $\frac{1}{4}$ x¾x16"; heavy-gauge ($\frac{1}{16}$ ") sheet metal, 6x12"; 2½ doz. flat-head stove bolts, $\frac{3}{16}$ x½"; 2½ doz. round-head stove bolts, $\frac{3}{16}$ x½" 1 doz. machine bolts, 6-32x½"; 2 machine bolts, 8-32x¾" 6 machine bolts, 4-40x1"; 4 machine bolts, 2-40x¾"; 6 metal screws, $\frac{1}{2}$ "-7; 2 springs, $\frac{3}{16}$ x1½", 8 to 12 oz. pull; 2 springs, 2¼x1", 12 to 16 oz. pull; 3 rubber screw bumpers; 1 doz. washers, $\frac{1}{4}$ "

Miscellaneous—clear plastic box lid, 3¾x4x½"; wide toy truck wheel or disc of hard rubber, plastic or hardwood, 1" wide x 2½"-in. dia., with $\frac{3}{16}$ " hole for motor shaft; rubber washers; hookup wire, 10'

The Doctor's Black Bag Is Full of Electronics

“WHAT IS THE DIAGNOSIS, computer?” When your family physician first asks this question of his latest diagnostic tool, you may shudder and long for the good ol’ days of bedside visits and the personal touch in medicine. But with the latest medical findings computer-stored at your doctor’s fingertips, you can do nothing but get well faster!

Physicians had the opportunity to participate in a demonstration of the potential use of computers as an aid in the diagnosis of disease at this year’s convention of the American Medical Assn. The computer, set up at the Charles Pfizer & Co. exhibit, was programmed with hundreds of symptoms and differential diagnoses based upon these symptoms.

We can look to the future use of computers in medicine to bring the same time-saving and accurate results as it already has in engineering and the physical sciences.

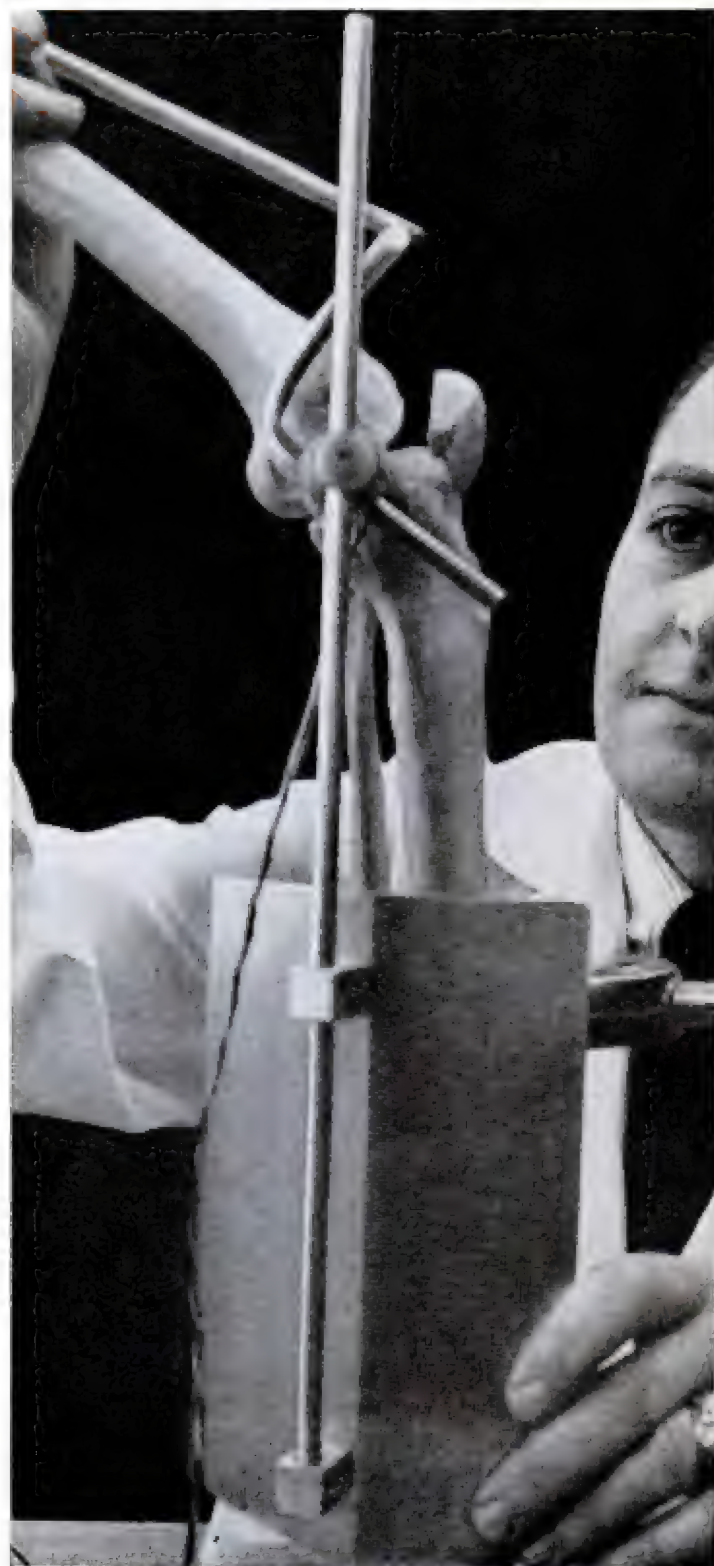
“Medical engineering” is a term we’ll hear more of as doctors and engineers collaborate in solving biological and medical problems with the use of electronics. At the Universities of Kentucky and Vermont, IBM engineers are providing physicians with technical assistance in a variety of research projects. Work is continuing on the much-publicized artificial heart; blood-handling heat exchangers have been prototyped; audiological tests are being developed for research in communications disorders; and electromechanical devices are being developed to study the human skeletal structure.

At the Philco Corp. where the biomedical engineering division has been doing research in power-assisted artificial limbs since 1962, further evaluation of a working model of a myoelectrically controlled artificial arm is continuing in

conjunction with the Temple University Health Services Center. The extraordinary artificial arm comes the closest yet to duplicating complex limb movements.

The device utilizes the biological electric signals that are generated by the muscles in action. The signals—called myopotentials or myoelectric signals—are picked up at the skin surface above the motor points or the muscle by silver electrodes. The signals are fed to a micro-miniature control circuit that amplifies

1



the weak bio-signal and processes it. The resultant voltage is applied to the arm which moves as desired by the wearer.

If you're losing sleep trying to figure out where applications of electronics will pop up next, relax, or get a sleep machine for your bedside. Edward Ashpole reports from Britain that D. R. Garner & Co., Ltd., has developed and is manufacturing a sleep-inducing machine. The insomniac just wears two headbands, each containing silver mesh electrodes. The machine

generates square wave impulses which are variable in frequency and intensity.

The frequency needed to doze off varies with the individual; some people drop off with 20 pulses per second, others need 100. Brain recordings show that wave patterns of natural and electrically induced sleep are identical; this isn't the case with drug-induced sleep, which is often accompanied by side effects.

What'll they think of next for us of frail flesh and bone!—*Bill Hartford*

2



1. MOTION OF HUMAN KNEE MODEL is measured by electromechanical device, and data is fed to a computer. Graphic presentation of motion results

2. PHYSICIANS PREPARE SYMPTOM CARDS for computer input at AMA convention. Readout of diagnosis, flashed on screen, is almost instantaneous

3. BLOOD-WARMING DEVICE is experimental prototype of a potential life saving aid that would make emergency surgery possible at "field" locations

4. SLEEP-INDUCING MACHINE, basically a square wave generator, applies pulses to the head through electrodes to bring on sleep without side effects

3



4



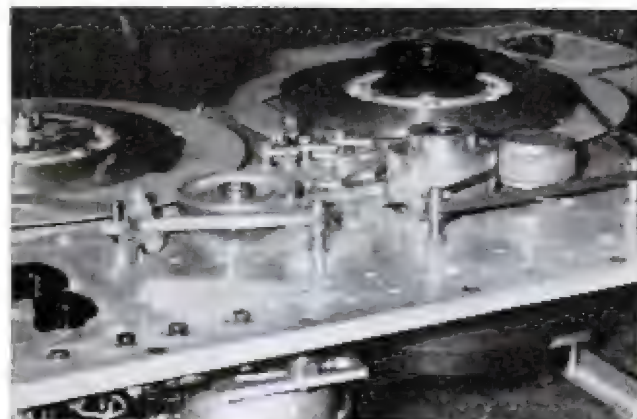
NEW IN ELECTRONICS



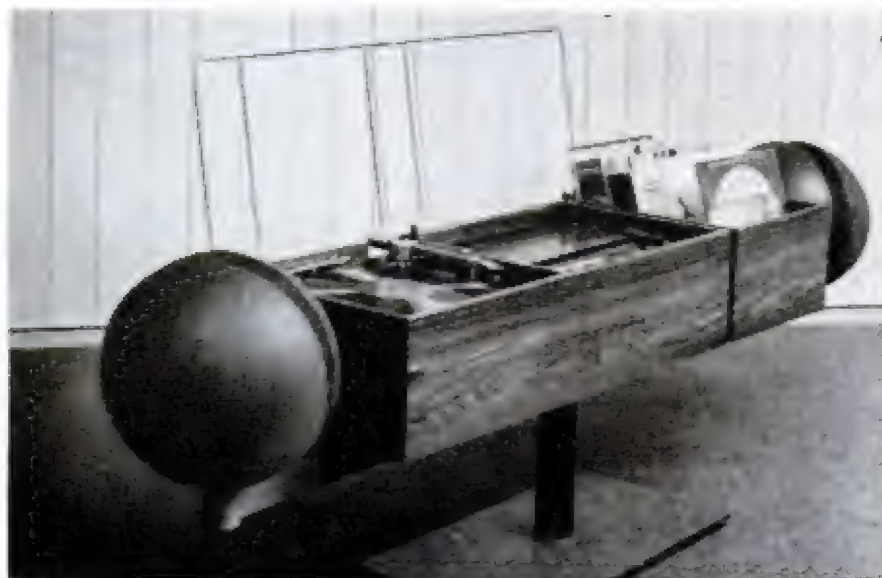
New pocket soldering pencil is rated at 35 watts. There's nothing startling about Fedtro's PSI-35, but it's extremely trim, and when you're finished soldering, just pop on the cap to cover the heating element and drop it in your pocket or toolbox—you don't even have to wait for it to cool off. You can get one for a very thrifty \$1.95.



Fancy video tape recorder is—by virtue of design and price tag (\$1495 for machine alone)—a training device for education, business, industry and the military. Wol-lensak calls this machine the VTR-150.



Tape recorder uses endless Mylar belt (blur in center of photo) in patented tape transport mechanism. High-speed tape flow of the new PAR video machine led to development of the precise mechanism.



Wildly inspired, this concept in the packaging of a stereo system for modern decor is Clairtone's Project G-2. It includes their own FM stereo tuner and amplifier and twin "Sound Globe" speakers which can be detached and moved around the house for almost any acoustical effect. A Garrard Lab 80 turntable and record bin handle discs. The complete G-2 system is \$995.

If you want a working pickup with a car-like ride



You're ahead in a Ford.



Extra toughness is everywhere in a '67 Ford pickup—except in the way it treats the driver. Seats are deep-cushioned, wider. A swept-away instrument panel and added shoulder room give new space for three. Twin-I-Beam suspension delivers a ride so car-like it's hard to believe. Optional Select-Shift Cruise-O-Matic transmission offers manual control or fully automatic shifting. Check your Ford dealer now for all the facts.



THERMOSTAT BOOSTER

(Continued from page 161)

time for you to roll out. If during the day you want to operate the thermostat manually, you simply push a button on the control which cuts out the clock.

The clock need not be near the thermostat, for the connecting wires carry only low voltage and can be run through walls or along baseboards safely. The flashlight cells that power the motor have lasted as long as two years in the original unit, though it's a good idea to replace them each heating season.

The timing control is an electric alarm clock with a plastic case. Take out the works and solder a light extension arm to the buzzer armature, and a small brass pin or bolt to the extension as a contact point. Bolt a small brass angle inside the clock case where the armature contact will be held off it until the alarm is tripped. It should then fall onto the bracket, closing the circuit, but should be held off the magnet core so that no buzz results. Bend the armature extension slightly if necessary to silence the buzz.

The drive unit is assembled on a hard-board panel cut out to fit around the thermostat. Build a battery case at one end for two D cells, and drill three holes for fastening the unit to the wall.

Worm drives nipple

A worm on a small permanent-magnet motor drives a 36 to 48-tooth gear mounted on a bicycle-spoke nipple. In revolving, this pulls or pushes a threaded spoke, which is linked to the thermostat dial.

Make the gear block first, tapping one end for two small bolts that hold it to the panel. Drill or ream the hole for the nipple to a close running fit. Turn a shoulder on the nipple, or ream out the hole in the gear, to a good fit. The gear must run true. Insert the nipple in the block, slip on a washer, and affix the gear by soldering. It must run free with little or no end play.

Mount the motor with shims under it if necessary to insure correct worm-and-gear engagement. It may be necessary to file some clearance in the block for the worm. Make the pivoted link of spoke parts as shown. Drill a hole in the dial rim at exactly 90° to receive the L-shaped head of the link.

The limit switch is a trip bar extending under the link head, which pulls it down as the dial is turned up. Tap the bracket for the pivot bolt, adjust this to let the bar move freely without excess play, and lock with a nut. Make the single-coil spring flexible enough to let the bar follow the link past the 80° setting, but strong enough

to hold the bar contact firmly against the adjustable point.

This may be taken from an old doorbell or relay, though a brass bolt will serve. Tap, slit and squeeze its bracket slightly to grip the contact screw and hold it in adjustment. The 1-in. hole in the front panel permits adjustment of a hex-head contact screw. If yours has a screwdriver slot, the hole isn't needed.

The electrical circuit requires two single-pole, double-throw, pushbutton or spring switches, and a similar slide switch. It is important to identify the common or blade terminals of all three, and on the spring switches the terminals to which the common is normally closed. Pushing the button or holding the toggle arm over should switch the connection to the other, normally open, terminals.

How it works

With the slide switch at "manual," both motor leads are positive. Pushing one button switches a motor lead to negative, turning the thermostat up. Pushing the other button makes the opposite lead negative, making the motor run the other way and turning the dial down.

With the slide switch at "clock" and the thermostat at a setting that lets the limit switch close, the tripping of the clock alarm turns the thermostat up, until the trip bar lifts off its contact. (Should the motor turn the dial down instead, reverse the motor leads.) Adjust the trip-bar contact to open at whatever thermostat setting you prefer in the morning.

Should long clock leads result in sluggish operation, connect an extra cell in one of them (with due concern for series polarity) as shown in the diagram. This cell will be in the circuit only when needed for the remote clock circuit, the other two being sufficient for local operation. ★ ★ ★

Camera is tossed overboard

A camera that simply gets thrown overboard is the latest tool of scientists investigating the ocean floor.

Dropped over the side of a ship, the camera descends freely to the ocean bottom, where it automatically begins taking pictures at a rate of one every 15 minutes. After a preset length of time, which can be up to several days, the device shuts itself off and rises to the surface.

The camera was developed at the University of California's Scripps Institution of Oceanography.

In tests, three 30 to 60-hour missions were completed at depths down to 11,262 feet. From 100 to 240 clear, distinct photographs were taken at 15-minute intervals during each mission.



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THE ABCs OF CARBURETION

(Continued from page 123)

it's possible to get even better gas mileage with a four-barrel carb than a two-barrel because the front barrels of a four-barrel are made considerably smaller. At cruising speeds, therefore, you should get better mileage. The rear barrels are made big to give maximum carburetion.

The new GM Rochester Quadrajets four-barrel is an outstanding development along this line. Front throats are only $1\frac{3}{8}$ inches in diameter; rear throats, $2\frac{1}{4}$ inches. There's a whopping 9.4 square inches of venturi area with all four barrels open. While the small front throats make some fuel economy possible, even on big engines, the second you "punch it" and open those larger rear barrels, you lose all the gas you've saved in a week on front barrels.

Actually, you rarely use all the carburetion capacity available in a four-barrel type. It has automatic air valves in the rear barrels that don't open, regardless of throttle opening, until the engine can use full carburetion—usually between 2000 and 3000 rpm with wide-open throttle. On the Quadrajets it's 4000 rpm. In other words, your two rear barrels are just along for the ride at any car speed below 70 mph in high gear. You wouldn't notice a big difference in power until you got up to 100 mph or so.

Same deal with multiple carburetion systems. Some manufacturers offer two four-barrel carburetors, or three two-barrel carbs as optional equipment on high-performance engines. Here, you wouldn't notice any improvement in power over a single four-barrel until the engine speed got up between 4000 and 5000 rpm. Since most automatic transmissions have maximum up-shift points at about 4500, the car would shift just as the carburetion was starting to come on strong. Obviously, you would need a special high-performance automatic or a manual four-speed transmission—where you shift above 5000 rpm—to get any good out of such exotic multicarb systems.

Carburetor adjustments have always been a mystery to the average car owner. They shouldn't be. There are practically no simple adjustments that will have an important effect on performance or gas mileage. When service station mechanics offer to "tune and set" your carb for

better performance and economy, don't expect much.

The only basic "tuning" that can be done outside the carb is adjustment of idle mixture and idle speed. These adjustments only affect idle smoothness and fuel economy on the idle circuit (up to 10 or 15 mph). Overall richness of the carburetor can be varied somewhat by going inside the carb body and adjusting the float level. However, this is preset at the factory and should not need adjustment for the life of the car.

Most common complaint

Actually the most common cause of complaint on modern carbs is a sticking choke valve—a butterfly valve in the top of the carb inlet. Closed, it cuts off the air supply, meaning engine suction will pull a very rich fuel mixture through the main nozzle. Obviously, if this valve doesn't open wide when the engine warms up, you will be running on a continuously rich mixture. The result will be very low gas mileage. If your mileage suddenly drops radically, check this first.

Just lift the air cleaner off when the engine is running (and fully warmed up) and you can see the choke butterfly in the top of the carb. It should be straight up and wide open. Another sign of a sticking choke butterfly is a dark smoke pouring out of the exhaust at idle or low speeds. A sticking choke can be freed by applying a little light engine oil to the ends of its cross shaft. If the choke isn't actually sticking, but still isn't opening properly, you'll probably have to replace the controlling thermostat unit.

Another common poor-running problem on some '62-'65 models—often blamed on the carburetor—is caused by the anti-smog crankcase ventilating system. Such systems are designed so carburetor suction draws "blow-by" gases from the crankcase back into the manifold to be burned in the cylinders. But if the little valve in the suction line should stick shut, the carb will run very rich because it was calibrated to run with extra air from the crankcase. It's a simple matter to clean the valve in solvent or replace it.

Your carburetor is one component on a modern automobile that should require no complicated maintenance for the life of the car. Just check idle speed and mixture now and then and see that the choke valve is kept free and working. ★★

I told Jim I wouldn't trade my old pump
till somebody showed me a better one.
He showed me his new Remington Model 870.
Know anybody who wants a good used shotgun?



Jim showed me all right.

I honestly didn't think there was that much difference between pump shotguns... until he pointed out some pretty special things about the Remington Model 870.

We placed his 870 next to my old pump.

First thing I noticed were the 870's double action bars. (My pump had just one.) Jim explained that double action bars give a velvet-smooth, lightning-fast shucking action that ordinary pumps can't match. No wobble, no binding, no twist. Makes

your second shot almost as fast as your first one.

Then Jim showed me the 870's modern receiver—machined from a solid block of ordnance steel. And the way the breech block locked solidly into the barrel. (It didn't on my old gun.) No wonder one Remington Model 870 has gone 226,000 rounds without repair!

As for looks... Remington's new fleur-de-lis custom checkering looked mighty handsome on the 870's American walnut stock. And Jim says the Du Pont RK-W "bowling-pin" finish is the toughest ever put on a gun.

The clincher came when I picked up Jim's 870 to check how it felt coming up to my shoulder. Next day I was on my way to pick up an 870 of my own!

My Remington dealer had more good news: Model 870 prices start at just \$99.95*, with over fifty barrel, choke and gauge combinations to choose from. (Including trap, skeet, magnum and rifled slug models.) Interchangeable barrels, too.

Interested? See your Remington dealer or send for the free 1966 Remington catalog. (Address below.)

Remington Arms Company, Inc., Bridgeport, Conn. 06602. In Canada: Remington Arms of Canada Limited. *Fair Trade retail prices in states having Fair Trade laws. Prices subject to change without notice.

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to fool you by stretching out the body to give you more loading area. We refused to give you the excessive rear overhang and exposed seams you find on some makes. Instead, GMC's Handi-Van gives you a tremendously stable ride. (You'll feel the big

If you think all vans are our new one over some





difference the first time you load up.) V-8 power is available. Safety equipment includes a padded dash, pushbutton seat belts and more. You'll have to go some to better our features. And you'd probably expect to dig a lot deeper into the budget to get a truck

that could even equal GMC features. Yet the prices of all vans are pretty close. If you still think vans are pretty much alike, there is only one thing to do. Go see your GMC Truck dealer. What a difference he can make on your whole attitude toward trucks.

pretty much alike, run railroad tracks.



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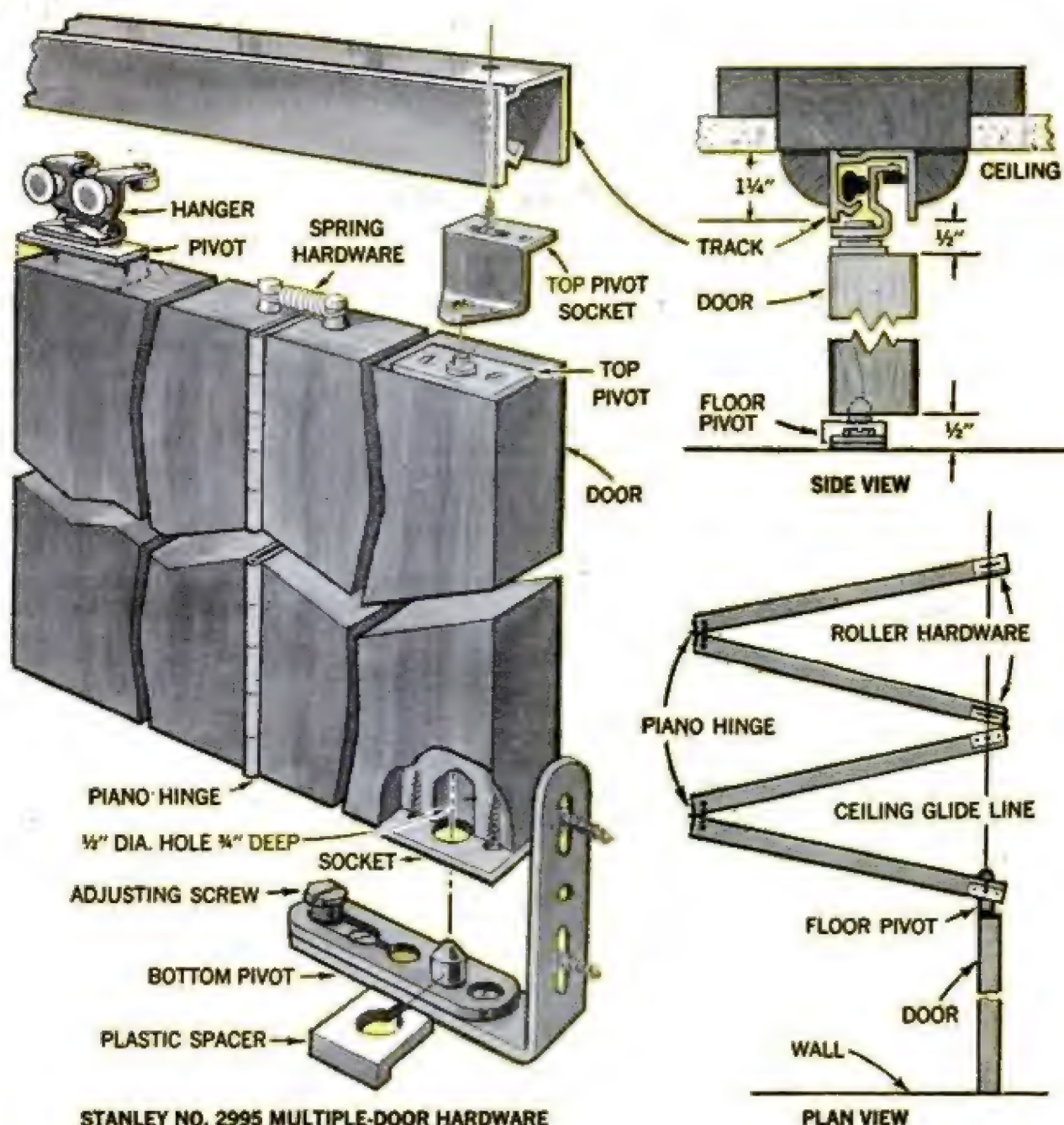


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STANLEY NO. 2995 MULTIPLE-DOOR HARDWARE

(Continued from page 142)

must be located so that the mounting screws can be driven into studs to assure rigid support. This is particularly important in the case of the desk-dresser. Pilot holes for the screws are made in the mounting strips provided across the backs of the cabinets. A temporary support placed on the floor under the units, will facilitate fastening them to the wall and checking to see that they are mounted level. The desk-dresser is mounted 8 in. off the floor, whereas the night table is 12 in. Stain and finish before hanging.

The accordion wall is made of 18-in. flush doors which are ganged together to hang from a ceiling track mounted in the center of the room. Your room will determine the number of doors required to extend from wall to wall. The doors are

hinged together at alternate edges so they'll fold, and equipped with Stanley's No. 2995 multiple folding-door hardware. One basic set takes care of four doors. The track in which the pivoting hangers ride is not a part of the basic set but is ordered separately in 2 and 4-ft. lengths.

All doors collect at one side of the room, and while the hardware is designed to allow the first door of the group to be located at the edge of an opening, such as a doorway, here it is hinged to a separate fixed door which juts out from the wall. This was necessary for the collection of doors to clear the night stands. Complete instructions for adding the hangers, top and bottom pivot sockets, as well as the spring-and-stud assemblies, come with the hardware. ★★★

WALT DISNEY'S CHRISTMAS MOBILE

(Continued from page 72)

comes apart in a jiffy for storing. The three sections of the main standard simply screw together into couplings, whereas the four lightweight conduit arms merely insert in wooden bearing blocks and lock with cotter pins. A short piece of pipe, driven flush with the ground and left there, forms a socket in which to stand the mobile. Fishline is used to hang the cutouts from the cross arms, and the slip-together tree at the top simply sets down over the pipe.

The cutouts can be jigsawed from most any 1/4-in. material you wish: plywood, hardboard or an all-weather board, such as Homasote. The originals were made 30 in. tall, but if you want to make a shorter or taller mobile than detailed, you can make them any size you want. In fact, used individually and enlarged giant-size, Mickey, Donald and the others can be perched on your roof, attached to the front door, or staked out on the lawn.

Project-a-Plans

To make it exceptionally easy for you

to enlarge the cutouts, we again have presented the patterns in Project-a-Plan form, an exclusive *PM* enlarging method whereby tiny patterns can be clipped from the magazine page, inserted in cardboard mounts and projected in a 35-mm slide projector for tracing directly on your material. This eliminates the job of trying to draw huge cutouts from tiny grid patterns, although we also have given the cutouts on squares so those who do not own a projector can still enlarge them by the old-fashioned square method.

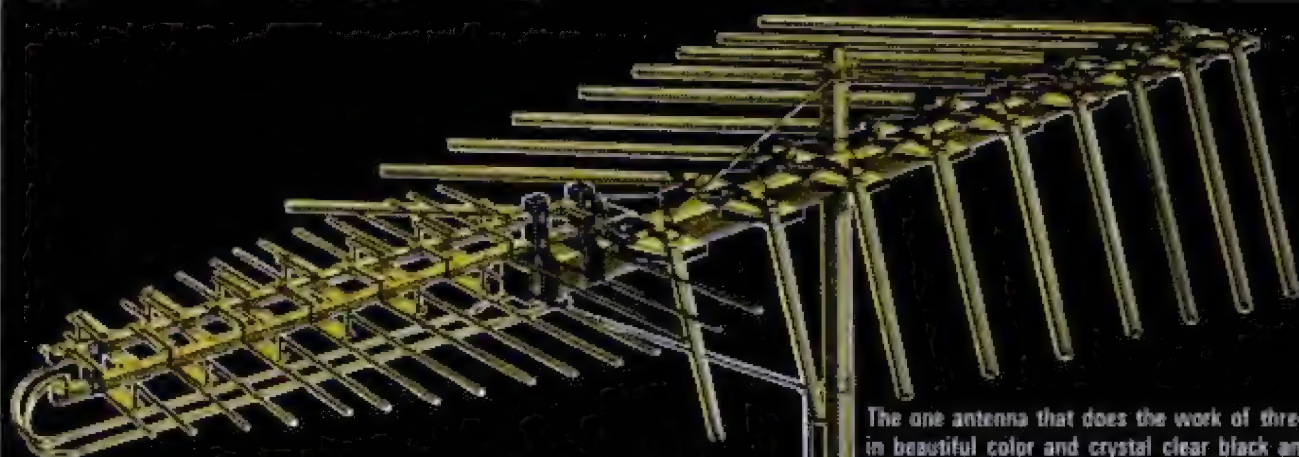
Where the cutouts are being made for the mobile, they obviously have to be painted both sides. Here, you'll do best to first roll the surface of the material with a sealer coat of flat white even before you start to project and trace the patterns on it. Of course, in the case of dark hardboard, it's really necessary to first paint it in order to see the projected line. The full-color patterns on page 73 provide a color scheme to follow in painting the cutouts. The pipe framework was painted dark green and wrapped with rope tinsel. It could be finished like a candy cane by first painting the pipe white and then striping it red. ★ ★ ★



Rail car with aircraft engines is running on Long Island

Now being tested on a 20-mile stretch of Long Island Rail Road track is the *Turboliner*, a new rail car that's powered by two 535-hp airplane-type gas turbine engines. The engines are located under the car and are geared directly to the axles at each end. During the tests of the new commuter train, the car is being run 16 hours a day for eight months. Its normal top speed during the tests is 75 mph, though the vehicle is capable of 100 mph.

The test car has a lightweight, stainless-steel body built by the Budd Co., and the trucks are equipped with air springs developed by the same firm. The gas turbines are made by the AiResearch Div. of Garrett Corp. Factors to be analyzed during the tests include performance, fuel consumption, safety, reliability, sound levels, vibration, heat and engine exhaust. All data will be shared with other railroads.



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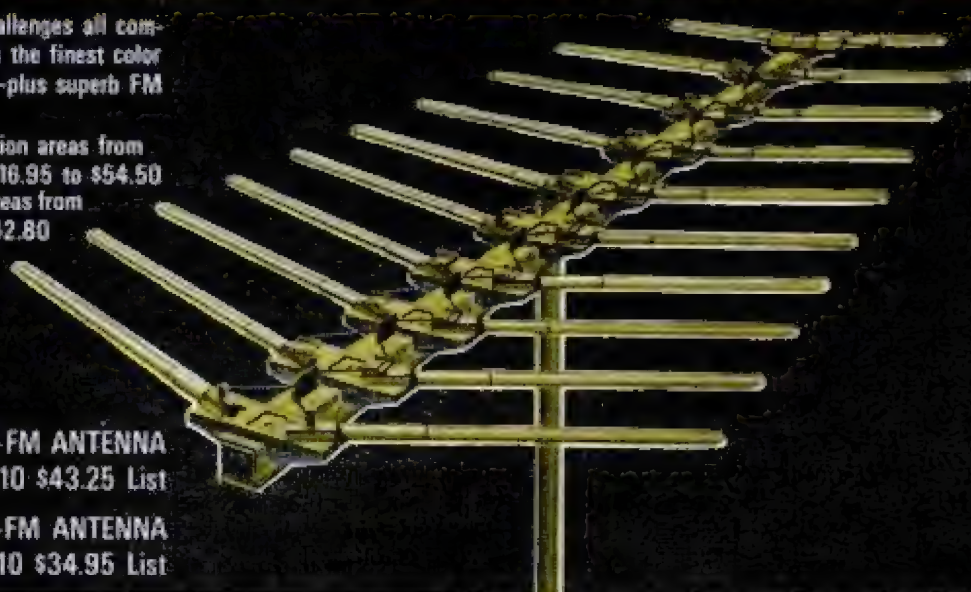
75-ohm models for poor reception areas from \$18.55 to \$62.80

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MAGNETS

(Continued from page 119)

would need a steel magnet 25 times as big. Because of tiny alnicos, the loud-speaker (which employs a magnetic device to convert the incoming radio signal into sound) has been shrunk to a fraction of its former size.

Then came ceramic magnets, developed during World War II. Doughs of iron oxides and other metals are poured into "cookie tins," baked in the needed shapes and magnetized. While they have by no means supplanted other magnets, these bricks have special advantages. They are easily made of common materials, will hold their strength for centuries and are so cheap that they have opened whole new fields of magnetic applications.

In 1940, Orange F. Merwin of Erie, Pa., a 68-year-old salesman of flour mill machinery, saw a garage mechanic use a magnet to pick up spilled metal parts. He had been listening to complaints from millers about stray bits of iron in their grain (from farm implements and fences), which damaged grinding machines and sometimes caused sparks to set off explosions of wheat dust.

Merwin set to work in his basement designing a magnetic separator which could be attached to a grain chute to remove the tramp iron. He got permission to try out his device in a flour mill. In one week it collected a double handful of scrap metal.

Even corset ribs

From these beginnings rose Eriez Magnetics, which now sells \$7 million worth of magnetic devices a year. Odd things happened to Eriez people during the early days. Once a salesman with a strong magnet in his suitcase set it down on a metal train platform and the porter couldn't lift it. The salesman had to slide it off. There was an embarrassing elevator incident when a magnet in a briefcase tried to annex a woman's metal corset stays. Once an engineer carried a magnet too near a secretary and a rain of hairpins resulted. Metal bars called "keepers" are now placed over the magnet poles to reduce their pull when they are not in use.

Demonstrating his magnetic separators in various plants, Merwin soon discovered that scores of industries had been paying heavy tribute to metal scraps. Installed in pulp mills, Eriez magnets collected ax heads and bullets which would have wrecked high-speed papermaking machines. In pottery plants, magnets retrieved specks of iron from the clay,

which would have rusted and ruined the appearance of finished dishes.

Eriez' director of engineering, Arlo Israelson, is always trying out ideas that may lead to new uses. He has been studying the various kinds of pull exerted on a skier's foot to see if magnetic ski bindings, which would part under a given strain, are practical.

Scientists at Utah State University reported that tomatoes ripened faster when exposed to a magnetic field. Israelson got some green tomatoes and found it was true. No one knows why this happens, but other biologists are studying the mysterious effects of magnetism on living organisms, work that may some day open a new field of uses. It has been learned that cancerous tissue in rats is less magnetic than normal tissue, a discovery that has led to the investigation of magnetism as a possible tool for early diagnosis.

Magnets do medical jobs

Magnets are used to remove metal objects from the stomach and lungs, and to locate and extract bullets from the body. When an amateur carpenter inhaled a carpet tack, an alnico magnet the size of a pencil lead, attached to a rod, recovered it from a spot deep in his lung.

More than 150 war veterans wear magnetized artificial eyes—developed by the Veterans Administration—whose movements match those of their good eyes. A tiny magnet, imbedded in a muscle of the removed eye, attracts another magnet in the artificial eye so that the replacement cannot slip out of correct position.

Jerome Murray, a professional inventor who has turned out a number of successful machines, shows a fascinating new device in his New York laboratory. He places a glass of water on a stand and drops a piece of metal in it. When he presses a button, the metal whirls and churns up the water. This is a simple demonstration of a versatile power source he has developed for kitchen use. It eliminates the need for separate electric motors for various appliances by concealing beneath the counter a single motor which spins a strong magnet. Motorless mixers, blenders, pot-scorers, juicers, fans and other gadgets placed on the thin countertop are operated by the magnetic force.

He has also designed magnetic snaps to hold the top covers of convertible cars, and a razor which holds the blade in place by magnetic pull. He puts his guests' coats on hangers which cling to metal shelves by means of 6-cent ceramic magnets; his files bulge with potential uses.

Another ingenious bag of tricks may

(Please turn to page 195)

Meet the most useful power tool ever invented!



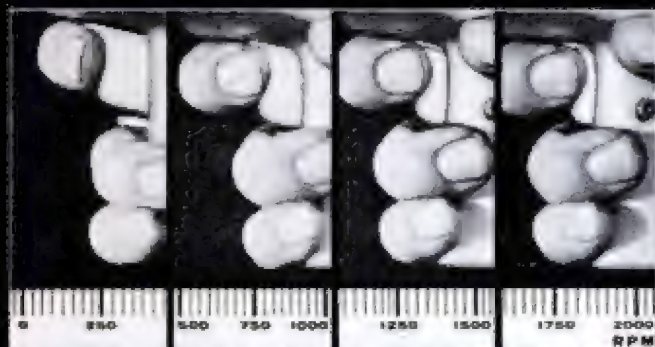
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An accelerator instead of an "on-off" switch gives you speeds from 0 to 2000 r.p.m. to drill any material.

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workshop of accessories. We call it **Drive-R-Drill**. You'll call it the most useful power tool ever invented. Comes in $\frac{1}{4}$ ", $\frac{3}{8}$ " and $\frac{1}{2}$ " sizes. Prices start under \$30 at better hardware, lumber and department stores. Skil Corp., Chicago 60630.

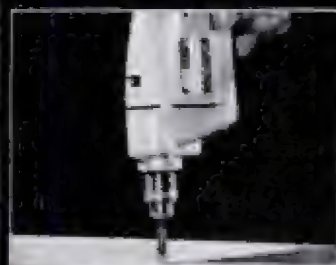
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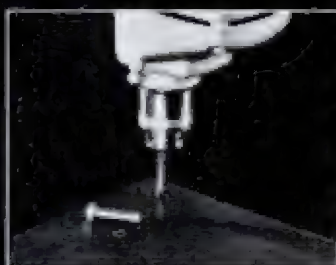
(1) Forward or (2) reverse at flick of a switch



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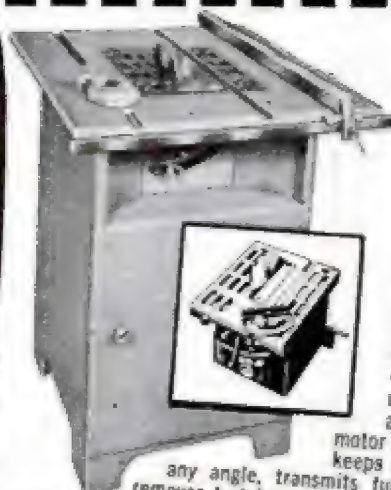
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Science; "(saw) boasts
many features of big-
ger brothers." Popular
Mechanics; "Amazingly
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struction, sturdy enough for production line use." Industrial Woodworking. And Workbench awarded these tools their coveted "Work Tested" Seal.

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DOES WORK OF \$75 BENCH SAW as is. Converts easily to equal any \$300 floor model cabinet units! Crosscuts, rips, mitres, cuts compound angles, dados, makes coves and mouldings.

\$14.95 f.o.b. factory. Wt. 25 lbs. Includes completely assembled cast iron and steel 8" saw with ground cast iron table... less blade. **RIP FENCE**, if desired, for easier work alignment, \$3.50 add'l.

SAW BLADE TILTS... TABLE STAYS LEVEL

Locks securely at any angle up to 50°, raises, lowers 0"-2 1/4". Patented tilt mechanism, accurate etched scale. Patented motor mount takes std. 1/4 h.p. or larger motor, keeps belt tight, assures perfect alignment at any angle, transmits full power. Takes std. blade, saw insert removes to take dadoe heads, cutters, etc. (not incl.). Accurate mitre gauge assembly. Ground spindle. Enclosed steel base. "Compo" bearings. Access. Std. size (for bench saw) \$3.50; larger fence (for cabinet base, as ill'd.) \$4.50.

FREE CABINET BASE PLANS Use as portable bench saw as received (inset photo) or transform easily and inexpensively into floor model (as shown) guar. to do work of floor models costing \$300. **FREE plans...** all you'll need are a sheet of 3/4" plywood and 3-4 hours. Use your AMCO saw for cutting. Plans provide 27" x 24" work surface, 33" height, tool storage compartment.

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DOES THE WORK OF \$40 UNITS... with same precision and speed. Turns wood, plastic. Sturdy cast iron with tubular steel bed. Ball thrust cup center, spur center, T-rest assembly, lever action tail stock, 2-speed pulley. Fits any motor.

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PRECISION 4" x 36" BELT SANDER

f.o.b. factory. Wt. 15 lbs.

\$14.95 Disc Sander attachment incl. disc bracket, ground cast table (tilts 0-45°): \$7.95 add'l.

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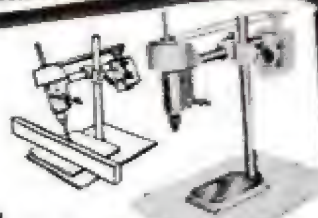
32" RADIAL DRILL PRESS

All cast iron and steel

f.o.b. factory **\$29.95** Wt. 30 lbs.

1/2" cap. Jacob's chuck incl.

DOES WORK OF \$90 UNITS... and much more. Industrial quality precision unit with all standard features, many extras. Head raises, lowers. Depth of throat up to 16". Pre-set to any angle for on-or-off table drilling, even horizontal drilling. **10-YEAR FULL SERVICE GUARANTEE.***



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FOR ANY OF ABOVE MACHINES. Wt. 17 LBS. PURCHASED SEPARATELY, \$18.95

MAGNETS

(Continued from page 192)

open up a whole new field for permanent magnets. It consists of methods of varying, or even turning off, the magnetic pull. (Electromagnets, which create magnetic force by passing a current through a coil surrounding a bar of iron, can be switched off, and this makes them essential in a multitude of important machines in which ordinary permanent magnets cannot be used.) One "on-off" device works this way: the strength of the magnet can be varied by slipping the magnetized bar outside its housing a given distance. One use is a magnetic scale for factory mixing operations. The magnet holds up one end of a hinged bucket to support a given weight. Incoming material trips the magnet when the weight is reached, and the material drops into a vat.

Magnets by their very nature lend themselves to spectacular stunts. Another "on-off" type was demonstrated at the Westinghouse Research Laboratory when a man wearing magnetic shoes walked upside down on a steel girder. He could "turn off" each shoe to make a step by closing a switch and sending a burst of current through a coil around the magnet.

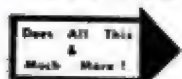
Ceiling walks may not become a fad, but such a device could be harnessed to make a strong lock with no moving parts for the doors, trunk and hood of a car, all under control from the driver's seat.

Magnets not only attract one another. Turn one over and it repels another with equal force. It takes the combined strength of two men to force together two ceramic bar magnets a few inches long. Using this characteristic, Westinghouse has built a small experimental railway car which glides along half an inch above its tracks. Linear magnets attached beneath it are repelled by magnetic rails; it can be moved by a finger as it supports a rider.

Westinghouse suggests frictionless, wheel-less, noiseless magnetic commuter trains which could float through the air at speeds above 150 mph.

Magnet technology has gone farther in the last 20 years than it did in the previous 20 centuries, and engineers predict further progress. Westinghouse, General Electric, Philips and many other firms are experimenting with new mixtures of metal "dough" in a constant search for stronger and better magnets. Meanwhile, manufacturers and lone inventors are dreaming up an endless parade of useful jobs for the old-new devices. ★★★

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PEARL HARBOR

(Continued from page 86)

short of decisive victory. When and if we win, I have no doubt that Mr. McNamara and his cost-effective computers, which wouldn't let the Navy build atomic-powered ships and saddled us with the TFX white elephant, will be able to prove that we won without spending a nickel more than we had to.

However, it behooves us to learn—and soon—that war is not a business subject to cost-accounting audits, nor is it a game played by amateur rules. It's a deadly battle for survival; and once the country is committed, it's everybody's war.

I saw a cartoon recently which sums up how too many of our citizens feel about the Vietnam war. It showed two crummy beatniks who had come to Washington to picket the White House and protest about Vietnam. They were looking at a statue of Stephen Decatur, one of our early admirals in the days of sail. During some hassle about foreign policy he made a famous speech in which he said, "My country: in her intercourse with other nations, may she always be right. But, my country, right or wrong."

The words "my country, right or wrong" are on a plaque at the foot of the statue. One "beat" looks at the other with a puzzled expression on his face and says, "I don't get it."

Our soldiers, sailors, airmen and marines in Vietnam get it. And thank God they do. It's time for us back home to get it, too, and get *with* it, if we are to keep faith with the boys who died at Pearl Harbor and those now dying in Vietnam! ★ ★ ★

WHITE-WATER RIVERBOAT

(Continued from page 157)

attaching them to the transom 16 in. from (and level with) the gunwales, and also to the gunwales. Put small spacer blocks between the inner and outer gunwales at the points of contact and use $\frac{3}{16}$ x4-in. carriage bolts to fasten the supports. Use $\frac{3}{16}$ x2 $\frac{1}{4}$ -in. bolts through the transom and transom posts.

Give the inside of the boat two coats of a dull, nonglare marine paint. (Light, bright paint is tough on the eyes.)

If, as Glen does, you like to stand erect when running white water, use the $\frac{3}{8}$ x36-in.-wide plywood rear floor piece shown. Otherwise, the floor strips can run the full length of the boat.

Complete blueprints and detailed building instructions are available from Glen Wooldridge, 913 S.W. H St., Grants Pass,

Ore. The price is \$7.50. He can also supply completed boats of aluminum construction and jet units for all 25 to 50-hp outboard motors. ★ ★ ★

RIVERBOAT MATERIALS LIST

No. Req'd.	Size and Description (Use)
1 pc.	2"x2"x14' lumber (deck stringers, transom posts)
1 pc.	2x4x16" (oarlock blocks)
2	1"x4"x10' boards (deck rails, bowplate frames)
12	$\frac{3}{4}$ "x3"x8 $\frac{1}{2}$ ' boards (rib risers, cotton frames)
1	$\frac{3}{4}$ "x2 $\frac{1}{2}$ " (or wider) x5' strip (lower cross-transom rail)
4	$\frac{3}{4}$ "x1 $\frac{3}{4}$ "x17' strips (outer and inner gunwales)
2	$\frac{3}{4}$ "x1 $\frac{1}{4}$ "x10' strips (keels)
2	$\frac{5}{8}$ "x2 $\frac{1}{4}$ "x16' strips (chines)
2	$\frac{5}{8}$ "x1 $\frac{1}{2}$ "x16' strips (rub-rails)
6	$\frac{1}{2}$ " or $\frac{3}{4}$ "x3"x9' strips (floor slats or strips)

(Above sizes net—use spruce, Douglas fir or white cedar)

1 pc.	$\frac{3}{4}$ "x4"x8' plywood (bowplate, transom, seats)
1 pc.	$\frac{3}{4}$ "x19"x6' plywood (transom stiffener)
2 pcs.	$\frac{3}{8}$ "x4"x8' plywood (bottom panels)
1 pc.	$\frac{3}{8}$ "x4"x8' plywood (deck, seat tops, splices)
1 pc.	$\frac{3}{8}$ "x4"x4' plywood (rear floorboard if desired)
1 pc.	$\frac{1}{4}$ "x4"x10' plywood (boat sides)
1 pc.	$\frac{1}{4}$ "x4"x8' plywood (boat sides)

(All plywood should be exterior or marine grade)

2 lbs.	6d galvanized nails
3 lbs.	5d galvanized nails
2 lbs.	4d galvanized nails
2 lbs.	3d galvanized nails
4	$\frac{5}{16}$ x4" carriage bolts, nuts, washers (transom supports)
30	$\frac{1}{4}$ x4" carriage bolts, nuts, washers (ribs, gunwales)
12	$\frac{1}{4}$ x2 $\frac{3}{4}$ " carriage bolts, nuts, washers (stiffener, transom ends, posts)
44	$\frac{1}{4}$ x1 $\frac{3}{4}$ " carriage bolts, nuts, washers (rib-frame joints)
20	1 $\frac{1}{2}$ " No. 8 fh (flathead) wood screws (attaching stiffener to transom)
48	1 $\frac{1}{4}$ " No. 8 fh wood screws (rub-rails)
1 box	1" No. 8 fh wood screws (sides, ribs, bottom, panels)
1 box	$\frac{5}{8}$ " No. 8 fh wood screws (side joint splices)
40	$\frac{1}{4}$ x1" fh machine screws, nuts, washers (bottom panel splices)
36	$\frac{1}{4}$ x1 $\frac{1}{2}$ " fh machine screws, nuts, washers (keels)
1	$\frac{1}{2}$ " eyebolt, nut, washer (bow tie-bolt)
3	$\frac{1}{8}$ "x $\frac{3}{4}$ "x20' galvanized or rust-resistant metal strips (keels, rub-rails)
1 pc.	$\frac{7}{8}$ x60" thin-wall steel tubing (transom supports)
1	drain fitting (transom)
2 lbs.	water-resistant glue

'Whipped-cream gas' for X-rays

The same gas cartridges used by restaurants to whip cream can supply gas to be injected in different organs of the body for a contrast medium before X-ray study.

A small gas syringe developed at the University of Oregon, Portland, facilitates the use of gas without fear of the formation of bubbles. It replaces cumbersome equipment required for gas as a contrast medium, Dr. Charles Dotter of the university's research team recently reported.

The syringe has a plunger that fits a standard 50-cc barrel and has within it a gas cartridge that holds about four liters of gas under pressure. The cartridge is available for a few cents.

Other members of the university's research team were Drs. Marcia K. Bilbao and Thomas B. Hutchings IV.

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WHERE EVEN SANTA GETS IDEAS

(Continued from page 79)

typical Chicago gusts. The answer to this problem also provided the answer to another: how to break the huge display down to a size that could be handled. The scene was manufactured in sections, with every detail carefully measured from the artists' drawing. Each section stands four by eight feet, with the fiberglass bolted to angle-iron framing on the back and sides.

Another problem was one of illuminating the display at night. To solve this one, Silvestri craftsmen used a shadow-box technique. Each section is built two feet deep. The entire display is lighted with 600 60-watt bulbs that require 29 20-amp. circuits to handle the load.

"Since we had to construct the scene in sections," Silvestri explains, "we had no idea what it would look like when assembled. Would colors match? Would figures come together properly?"

Silvestri admits he had his fingers crossed as each section was finally lifted by crane over the store's facade. When the 60 sections, totaling 12,000 pounds, were finally bolted into place, even the hardheaded workmen who did the job stood across the street from the store and stared in admiration. The display has been hit by winds up to 70 mph and hasn't so much as tottered or developed a tear.

Since 1939, when Silvestri joined his uncle's plastering shop employing a handful of people, and transformed it into the largest Christmas display company in the country, the entire crew has leaned toward "king size" in everything they do—profit-making as well as creations.

Too big for the Navy

But bigness created a problem for the company during World War II. The Navy asked for several giant displays, among them a number of globes.

"Make 'em big," the Navy ordered. How big was left to Silvestri's discretion—so he made them six feet in diameter.

When the Navy took delivery of the perfectly round, iron-reinforced plaster spheres, it was found that they wouldn't fit through the doors of classrooms—not to mention hatchways of ships.

"We wanted them big, but not *that* big," the Navy told Silvestri.

So, the globes were remade, and this time Silvestri had to console himself with the artistic part of the job instead of size. He made the globes 30 inches in diameter, which filled the bill and fitted the doors.

Silvestri is not an architect, sculptor or artist. He's an idea man. The ideas for

most of the displays the company sells originate within the company. An average of six months is needed before a finished display is ready for showing. Professional designers and draftsmen draw up the project. Plans are sent to the sculpturing department for the making of clay and split molds. Then, the molds are sent to the rubber department where the actual figures are formed in latex.

From there, another department takes over to mechanize the figures. Back go the figures to the rubber department for patching, and then on to the painting department for spray painting of large areas and hand painting of small portions. Finally, the handicraft department takes over to dress and adorn the figures.

But still the display is not ready. In the case of mechanization, the figures are quality-controlled. They are turned on and allowed to run continuously for several days to insure that synchronization is perfect and that a faulty part won't break down in a customer's window.

Dancing lights

This careful planning, modeling and testing is coupled every year with a new display, or technique to show the trade. One such successful idea was the work of Silvestri's son, George Jr. It was a way to make tiny Italian lights appear to dance in perfect synchronization to music, and it meant *inventing* a system to do the job. A patent is now pending on George's brainchild.

One of the chief elements of the creation, the Italian lights, are miniature bulbs formed into various shapes, such as flowers, bells and pine cones. They are used to decorate Christmas trees and windows or to make an actual structure, such as Silvestri's Waterfall of Light.

George's invention makes use of a solid-state device to control light intensity. A sound source is applied to the box, which contains a crossover network that divides music into three channels—bass, midrange and treble—just as music is divided into ranges in your stereo system.

The tiny lights follow the music to the very pitch, from thundering crescendo to barely audible diminuendo, blinking in intensity according to the musical range.

If you happened to be at Halle Brothers in Cleveland, or the Water Tower in Chicago, or the Eastland shopping center in Detroit last Christmas, you saw Silvestri's dancing lights.

No matter where you live, though, chances are you've seen a Silvestri display. What they say about Santa Claus also applies to the ingenious Silvestri: It wouldn't be Christmas without him. ★ ★ ★

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HIGHWAY SAFETY

(Continued from page 92)

corrugated cardboard and a powerful fan. The idea is to chill cylinder and contents to below minus 100°F., using Dry Ice. However, thermal shock might crack the cylinder open if Dry Ice is applied directly to the metal. That's where the cardboard comes in: it's wrapped around the cylinder and "ice" is applied outside.

Now there's a good chance the leaking CTF vapors will set the cardboard on fire. That's why the fan is needed: to blow vapors away. Once the cylinder and contents are down to temperature, it's perfectly safe to replace the faulty valve.

One morning I had a call from an Air Force base: a CTF cylinder was leaking and no one dared approach it. Would we come out and stop the leak? The job didn't take more than a couple of seconds, for the cylinder was lying on its side, and it was the lower valve that was leaking. All we did was rotate the cylinder to bring the bad valve uppermost. In this position it didn't leak because vapor instead of the heavier liquid was pressing against it. "Hell, I could have done that myself," was the thanks a colonel gave us.

Then there's fluorine, which in various combinations is a very important industrial chemical. In its pure state it is the fuel for the new FLOX (fluorine-oxygen) engines that power some space rockets. The pure product is manufactured chiefly in Illinois and trucked to all three coasts.

Despite its virtues, fluorine has handling problems. It's a poison gas. It sets steel on fire. Ordinary sand flames up in its presence. Pure fluorine is so reactive that it attacks anything, including its own container if the container isn't specially treated. It is shipped as a cryogenic liquid, chilled to minus 306°F., in specially-built semitrailers. Fluorine trucks may move only under special ICC permits.

Los Angeles requires advance notice when a fluorine tanker will be in that city, and the route it will follow. All fire stations close to the route are notified ahead of time, with emergency instructions. The Los Angeles County fire manual says: "No attempt should be made to handle any incident where fluorine gas is present. Evacuate the area . . . no known protective clothing . . . affords full protection."

Fortunately there has been no "incident" involving fluorine in transit, as far as I know.

It's said that a nuclear weapon that could overkill a large city is a relatively safe cargo because of its many safety devices. There is a hazard, however, in the

high-energy explosives that serve as the bomb's detonator. It's best to stay far away from any incident in which an A-bomb carrier is involved.

There's quite a bit of traffic these days in other radioactive substances, including the "pills" used for X-raying welds, and the tracer materials used by hospitals. These are classed as "Class D" poison. If heated to the combustion point, as in a fire, they produce radioactive smoke.

There's one "high hazard" cargo that is so common that everyone tends to forget its potential. That's gasoline. Every now and then we are all jolted when a big fuel carrier is wrecked and catches fire.

If you suppose fire chiefs are frightened by increasing traffic in dangerous cargoes, you are more than right. Many tell me privately that they are afraid major catastrophes are inevitable in their areas. I agree. We've been lucky so far.

Luck rides bomb truck

As an example of pure luck, there's the recent news item that reports what happened when a station wagon skidded into the side of a truck loaded with incendiary napalm bombs. The truck went out of control, hit a tree, which knocked the driver out of his cab, and the truck finally came to rest on a busy railroad crossing. Here the truck lost a wheel, which bounced along the right-of-way until it smashed into a switchbox. This caused a short circuit that halted a train headed for the scene!

Professional firefighting associations are aware of the gravity of this problem and doing what they can. I can tell you our hopes, since I'm on special committees of the National Fire Protection Assn., the Fire Protection Officers of California and the California Fire Chiefs' Assn.

For one thing, we are trying to provide information to firefighters everywhere on how to control each special kind of hazard. Not much literature is available now. Hopefully, the NFPA in Boston may complete a special manual next year.

Too, we want tighter federal and state regulations on the placarding of vehicles hauling dangerous cargoes. The placards should tell three things: degree of danger (such as "Explosive"), type of material (such as "Corrosive"), and name of product. We want large, truthful placards on all sides of a vehicle, in all cases.

The ICC is moving this way but is meeting resistance from interests that feel such signs "would frighten the motoring public!"

That's not our purpose. Those placards are intended to give firefighters a better break. They need it. ★ ★ ★

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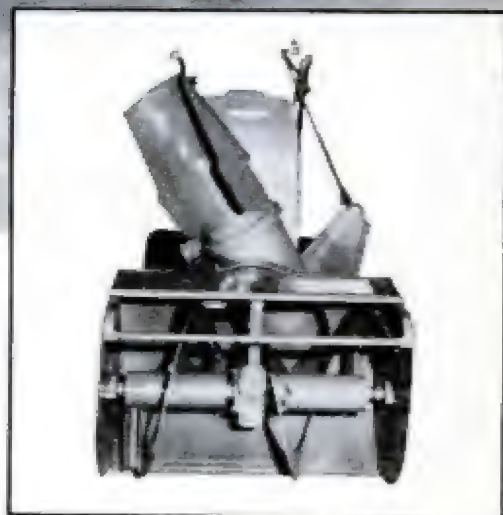


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SUCCESSFUL INVENTIONS

(Continued from page 105)

motor wasn't powerful enough.) "When you try to sell it, the people around the table will tell you all the reasons it isn't any good. They'll be against your idea partly because they didn't think of it, partly because they may have to stick their necks out if they buy it, and partly because it means hard work to turn an idea into a product ready to sell. So be sure any machine you present for sale can't be destroyed by words."

Second suggestion: "Pick three companies that could logically manufacture your invention and present it to all three simultaneously. Tell each one that two others are looking at it. Fear of competition is a stronger motivating force than desire for a new product."

One final tip: Don't be afraid of getting short changed by the big companies because you're new at the game. "The price for most inventions is almost as standard as the price of a can of soup," says Walton. "Fabric processes, for example, usually net the inventor one-quarter to one-third of a cent per pound of material treated. Small appliances to be sold outright—such as a toaster—bring about a 5 percent royalty." The exact price is negotiated, says Walton, but, the general level is pretty well set.

Started at bottom

Before World War II, Walton was employed as a quality control engineer, then switched to sales. After the war, he worked for a textile engineering company but didn't like it. In Nov., 1951, he decided to become a free-lance inventor.

His first invention was the small electric machine that washes clothes in any sink or bathtub. He took it to the Hoover Vacuum Cleaner Co., and a short time later got the verdict: No. Walton was too discouraged to make another attempt until a friend urged him to take it to Bendix. It was a lucky break. Bendix bought. The washer appeared on the market in the mid-1950s under the AMI brand name. (Today it's manufactured by Franz Electric Industries of Cleveland.)

Walton still doesn't consider the washer a real success. "I suppose I've made \$100,000 out of it over the years," he says, "but it never did sell the way we hoped. You can't count on consumer products as you can on industrial processes."

Even after his first sale, Walton's inventing career was far from a string of triumphs. An early project, for example, was a flatbed washer. With it, he reasoned, laundries could set up a conveyor

belt, put clothes on it and run them through washing, drying and folding machines automatically. "I didn't know at the time that you can't get people to touch dirty clothes," he says. "They'll dump them out of bags into tubs, but they won't handle them."

Despite periodic failure, though, Walton also turned out a mounting list of successes. And in the process, he discovered a number of principles that he feels will help any inventor increase his chances of success. Among them are:

1. *Invent by the rules.* Companies have a huge investment in their going product. They have a trained service organization, millions in tooling, millions more in spare parts. Why should they gamble? If they tried something totally new and it didn't catch fire, they'd be wiped out.

What a company will buy, he says, is something that won't interfere with the going product; in other words, a new agitator or something that can be bolted on without major changes. Both the flexible agitator on the Whirlpool washer and the Jet Action agitator on the Frigidaire are Walton's patents.

Searching for ideas

2. *Look to new materials for ideas.* "There's a vast amount of inventing," Walton says, "that can be done by applying new materials to old problems."

3. *Be alert to new ideas everywhere.* To learn what industry needs, read trade magazines, go on plant tours, talk to people who work in factories. At work, look around and see what's being done by hand, or where a process is complex, messy or expensive.

4. *Apply your ideas in many fields.* While Walton was developing his shrink-proofing process for knit goods, he continued to work on paper creping. A machine called the micro creper was the result. (It compacts paper between a single roller and a tight metal shoe.) Already in use in many plants, it will soon be going into more.

5. *If you have a good idea, keep trying.* "I'm a try-again inventor, not a theoretical one," says Walton. "We never make a drawing. By the time we could draw something, we can rough out a model from sheet metal and get an idea of whether it will work or not."

Is there any special quality, any particular ability needed for successful inventing? "Continuity and determination are more important than anything else," says Walton. "A high IQ is not necessarily a prerequisite. But an inventor must be able to isolate everything from his mind except the current project. ★★"

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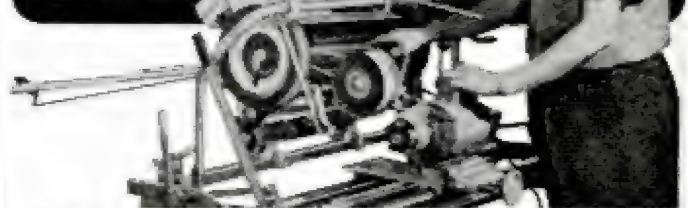


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THE GIANT STAGE THAT SHIFTS

(Continued from page 113)

can't be done in most theaters during a performance. It can at the new Met. Wings in which the wagons are parked can be sealed off with three 32-foot-high sound-proof doors that slide down silently.

The stage wagons carry a whole load of tricks. The huge steel and wood platforms break up into sections which move around separately. The 60 by 40-foot one, for instance, breaks up into one driver and six "slave" sections. These, in turn—like checkerboards—break up into 30 small platforms measuring 6 by 8 feet, whose surfaces can be tilted to any angle and locked in place. They produce the raked (sloping) stage favored by many directors.

The main stage, with its elevators and surrounding aprons, is 100 feet wide and 80 feet deep. But the rear stage can make the depth 146 feet. Only Poland's Warsaw Opera has a larger mechanized stage.

The entire depth is used for the arrival of Cleopatra's barge in *Antony and Cleopatra*, the triumphal procession in *Aida* and other spectacular scenes. However, the main stage without rear extension can perform plenty of tricks on its own.

Thirty-two openings (invisible to the audience) allow performers to walk up or down steps to or from the stage—appearing or disappearing suddenly in a puff of vapor from the "steam curtain." The steam pours from tiny holes in the stage at the curtain line when a few switches are flicked at the control center. In seconds, for instance, a wall of steam obscures the stage while Mephistopheles, rising through a stage trap, seems to materialize out of thin air before Faust.

Handling the king-size backdrops is a far cry from the old system of mechanical counterweights. The 72-foot-long wooden battens to which dropcloths are tied are hooked to rectangular steel tubes about 1 by 4 inches. There are 109 tubes hanging above the main stage, about 5½ inches apart, and 14 more over the rear stage. Each "pipe," individually controlled from the main console, is hung from six ¼-inch steel cables which wind on a single drum to an upper grid 110 feet above the stage. (There are two grids, one above the other. The top one carries drops; the other, lights.) Some 654 cables weave through a maze of direction-changing pulleys overhead like a vine-filled jungle.

As many as 30 different "pipes" can be raised or lowered simultaneously by a single lever. The secret is automation! All movements can be programmed in advance. The precise distance each individual drop should be lowered for a given per-

formance is determined in rehearsals and stored in the machinery's computer memory. For a different opera, circuits are changed through a big patchboard in back to move an entirely different set of pipes in predetermined patterns.

Development of the pioneering system, spearheaded by the Met's Louis Edson and Rudolph Kuntner, was engineered by Syska & Hennessy Inc. and Cutler-Hammer Inc.—along with the counseling of Berlin's Walter Unruh.

Bridges for lamps

The lower grid, 10 feet below the first, has hoisting machines to move six light bridges. These heavy steel frames carry powerful lamps to light the stage. About 70 feet long, they are just wide enough to hold the lights and a narrow catwalk for electricians who service them. Lights are controlled from switchboards filling three sides of a large room at the rear of the orchestra floor. These can be preset for a dozen changes automatically, but the actual moment for any change is determined by an electrician in the control room.

The lower grid also supports two massive cycloramas, each 101 feet high—tall as a 10-story building—and 117 feet wide. When not in use, these tremendous painted canvases (each weighs three tons) are rolled up, one at either side of the rear stage where they hang from brackets. The brackets run around U-shaped tracks, so that either cyclorama can be moved to cover the back and sides of the stage—usually for outdoor settings. A cyclorama produces an illusion of open sky when seen behind a set.

The 83-year-old Metropolitan Opera usually presents about 25 different operas a season, often as many as seven a week. Before, sets had to be trucked in daily. In the new building, a tremendous 32-foot-high storage area below the stage can hold the sets for an entire season, if stored flat—or for a dozen operas, if partly assembled. The space is reached by two rear elevators—10 by 25 and 25 by 30 feet—to bring up partially or fully assembled sections of sets: anything under 25 by 30 feet and 30 feet high, including the largest mobile organ ever built.

One more really "wild" elevator, 72 feet long by 4 wide, really is a section of the main stage floor. This "drop-cut lift," will hold a dozen rolled-up backdrops and as many stagehands. It sinks into a 33½-foot-deep narrow vault where a dozen men heaving at once can easily lift a 400-pound drop from the elevator to a row of large brackets and pick up a new one.

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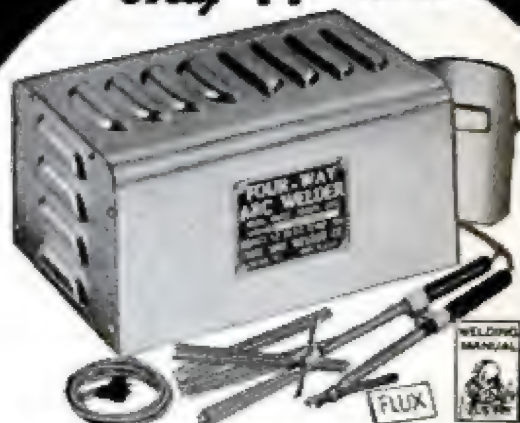
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PHONE TATTLES

(Continued from page 177)

angle support, drill and bolt to the upright.

Cut sheet-metal lever arms to spring-pull the dialing motor. Drill a hole for the end bolt and another three or four small holes starting near center and toward plunger end of arm for spring anchors. Be sure to elongate the holes through which the solenoid plunger pin must pass to prevent binding of plunger stroke. Insert rubber washer between the lever-arm ends within the plunger fork; this will greatly reduce solenoid hum and vibration.

Test for easy movement

Drill and insert anchor bolts for springs in the plastic slide. Clip the other end of the spring into corresponding holes drilled in the lever arm. Work the solenoid plunger with your finger; try different positions for the spring anchor in the lever arms. Motor and slide should pull up without binding and return to the unengaged position easily by gravity. Use powdered graphite lubricant in the slide grooves.

A hard-rubber toy truck wheel 1 in. wide and of 2½-in. dia, forms the "program" drum, a most important component of the Phone-a-larm. When turned at 1 rpm by motor M1 and rigged with dialing clips, it will dial any number you program onto it by alternately making and breaking the circuit through switch S3. One complete "track" for the dialing clips allows for proper spacing. Now form a second track on the drum, space the wire clips to trip switch S2.

After motor M1 is mounted on its panel, predrill or punch a hole in the wheel hub to match the position and hole in the shaft of the motor. A ¾-in wire brad (16-ga.) can be inserted as a pin through the wheel hub and shaft, using needle-nosed pliers.

Before mounting the drum motor assembly, be sure to go back to the framework and attach the two 3x3-in. angle irons for supports. First, use your drill or router to elongate the two holes in one arm of each angle iron about ¾ in. Then bolt the irons onto the top of the 6-in. arm of the shelf brackets, with the inside angle approximately ¼ in. from the end of the bracket arm.

Next, prepare the sheet-metal panel which serves as front top panel support and switch-mounting panel. Its dimensions are 2x7 in. after ½-in., 90° edges have been turned all around. Bolt this into position, flanged side back, 1½ in. from the front of the panel to the inside of the motor and drum panel.

The tripper finger assembly comes next.

Start with a 1¼x2-in. piece of sheet metal. Cut and shape it and drill two ⅜-in holes in the base, each on center ⅜ in. from the edge for mounting. Drill each hinge-pin ear with a ⅛-in. bit for inserting a 1-in. brad (16-ga.) or piece of wire. Bolt this assembly into place.

After trying various materials for tripper fingers, I found that an inexpensive, rigid teaspoon handle was the perfect answer. Use a hacksaw or heavy side-cutting pliers to cut into the bowl. File or grind handles down to a fairly uniform width of ⅜ in. near the end of the handle. Cut and square off the handle end so that remaining total length is 3⅜ in. Use a ⅜x¾-in strip of sheet metal to form a hinged support for the trippers. Coil the end of a metal strip around a piece of wire or wire brad about ⅛ in. dia.

To insure a snug hinge-pin fit, fill the coiled end with solder and drill out again with a ⅛-in. bit. Solder the coiled strip into a filed recess on the end of the spoon handle—the final overall handle length should now be 3½ in. Fit the tripper fingers into the mount with a small nut between to separate the fingers about ⅛ in. Insert pin and secure with solder.

Insert a test wire clip into each track of drum. Temporarily connect the drum motor to current supply, wiring as indicated for counterclockwise rotation. As the drum turns, check fingers for proper alignment. With the two tripper fingers riding atop the test wire clips and the motor stopped in this position, hold the assembled switches immediately over the fingers, with pin plungers of the switches near the midpoint. Measure for length of wooden or plastic standoff dowels. Cut the standoffs, reposition switches with pin plungers located over fingers as before, but with plungers pressed in; mark, drill and bolt in this position.

Suspend the panel

The panel for mounting the receiver-lifting solenoid should now be suspended approximately midway atop the horizontal arm of the shelf bracket. The clamp for lifting the receiver should be attached near its center with the springs attached to the clamp and solenoid plunger. With the plunger held fully inserted into the solenoid, position the mounting panel, including vertical adjustment, until the receiver is raised sufficiently to permit the telephone cradle plungers to rise to maximum height—about ½ in. Bolt and secure panel in this position.

Complete the mounting and locate the remaining electrical components:

1. The delay relay, with its octal tube

(Please turn to page 208)

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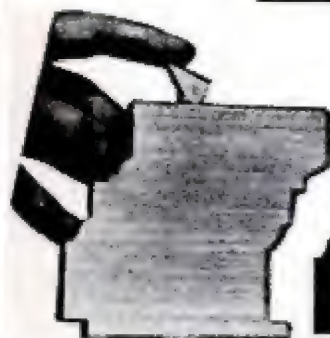
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PHONE TATTLES

(Continued from page 206)

socket can be mounted vertically on the back panel in the "loft" section.

2. Mount relay K3 and switch S4 in the loft area—near the right side for easy access. Mount the relay with the plunger in a horizontal position, and fabricate a small sheet-metal clip to keep the plunger engaged and switch S4 closed when the alarm trip switch S1 activates the relay. In this manner the Phone-a-larm continues operating until the 180-sec. relay K4 cuts it off. Reset the alarm by lifting the fabricated clip to allow the plunger of K3 to return to the off position and switch S4 to open.

3. Wire the two capacitors supplied with motors M1 and M2 as shown in the schematic. With the black leads connected together and voltage applied to the black and white leads, clockwise rotation results; current to the black and red leads gives counterclockwise rotation.

4. Finally, mount the transformer 5-½ in. above the bottom edge of the rear panel, halfway between the brackets.

If terminal strips are not used, solder and tape all connections (see schematic). When completed, mount the top panel.

Although wire clips on the program drum are approximately ⅛ in. long for each dial fingerhole or digit, the length will vary according to the telephone dial size and circumference of "clutching" point of rubber stopper roller. Be sure the lower edge of the dial fingerhole of each digit of the called number approaches the dial finger stop at the instant of cutoff. Set clips enough apart for return of the dial between dialed digits.

Once the dialing track is complete and accurate, insert a wire clip ½ to ⅝ in. long in the receiver control track. This should drop the receiver approximately 8 seconds before the dialing cycle.

To set the alarm, operate the drum motor until the tripper finger for the receiver has just dropped off this clip; it will then pick up the receiver the instant the alarm is tripped and approximately three seconds before dialing.

The entire alarm must be concealed and soundproofed if it is to tattle successfully and secretly on unsuspecting burglars. One further note: It's very important that your program drum be constructed very carefully to dial *your* telephone number only. A malfunctioning Phone-a-larm can ring wrong numbers and tie up telephone lines. ★★★

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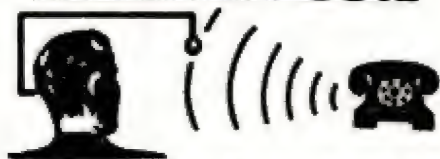
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SKI PARALLEL IN ONE DAY

(Continued from page 129)

need all that power. A little unweighting will make the turns easier to execute, but all you need is a slight downward pressure of the knees. You can also unweight by an upward motion, but the downward knee pressure is smoother and you can make quicker turns without any loss of control."

I followed directions and immediately began making effortless linked turns. The body always faces downhill, with the hips and legs handling all turns.

"If you're skiing relaxed and naturally," said Clif, "you don't need a lot of rules about reverse shoulder and leaning out from the hill. You know that you can direct the skis or come to a stop, so you're not caught up in a feeling of fear. In this frame of mind you just think ahead to what you want to do, where you want to go, and the body automatically reacts in the proper way."

Fun on a bumpy slope

I felt the usual tightening sensation when we moved over to a slope covered with moguls (bumps). Like most intermediate skiers I had suffered my share of bruises from tangling with moguls and I wasn't keen on a repeat performance. With the Shortees, however, they added to the fun. You have such complete control over the small skis that you can use the bumps like an expert, sliding up the side to allow the contour to make your turn, then slipping into a trough, zipping down, then up over the top and sliding down the opposite side, using the next rise to lift you and turn.

And this was the first day that I had been on Shortees!

"From now on it's just a matter of practice," Clif said. "You should use those skis until they feel as familiar on your feet as your shoes. That's when you'll begin to ski instinctively. When you're on ice you'll automatically seek more control and you'll lean more forward to use the edges. In soft snow you'll just automatically move your weight back to keep the fronts up."

I spent another three days at Hogback, skiing every slope they had, learning and enjoying every minute of it. Then I went up to Killington to try the expert slopes on a king-sized mountain. I had a few tense moments on a steep, icy slope, but I mastered that on a second try and sailed down with the greatest of ease.

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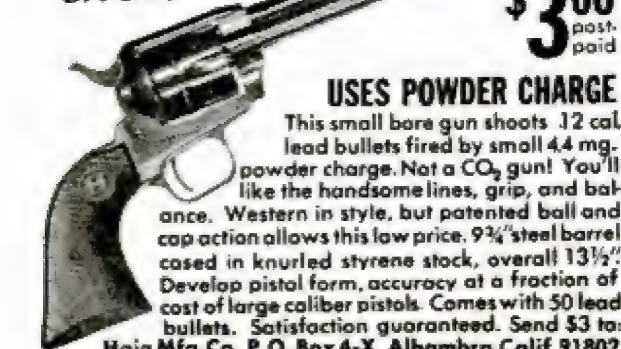


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BETTER CHRISTMAS PHOTOS

(Continued from page 147)

before family guests arrive. A gallery of observers can make the kids shy or show-offs. In fact, you're better off shooting a day or two before when you first trim the tree, rather than during the hubbub of Christmas eve, when you have to get to assembling toys with "easy-to-follow" instruction sheets. Avoid onlookers, but one helper can be an asset, though, to distract the children and hold lights or reflectors.

Photofloods with indoor, Type B, film are the easiest to work with, but the glare can be particularly annoying to children. While floods permit you to see your lighting effects in advance and squeeze off shots quickly, you'll need a light meter. Nonadjustable-camera users should stick to flash. Make sure that with indoor film you stick to clear flashbulbs. Daylight film can be used with blue bulbs.

Flash and speedlights, on the other hand, simplify camera settings, and meters aren't needed. But these sources can lose you some of those desirable spontaneous shots during bulb changing or capacitor recycling. Further, unless you have slave units, you can't balance your lighting very well. Extra floods are much less expensive, though.

Bounce lighting is best

If your flash can be removed from the camera or tilted on camera, try bouncing the light from a light-colored wall or ceiling, particularly for closeups. Head-on, on-camera flash at close range will increase subject blinking and wash out detail. You can help to fill in your lighting by having your helper hold a white art-board or foil reflector at the opposite side.

If you can use slave flash or a second flood, position it to one side or at a three-quarter angle and let it be the key-light. Move the light that's at the camera angle back or mute it with one or two handkerchiefs draped over it. Generally, the lights should be at a slight angle above the subject for the most flattering shadows. If the lights are too low, grotesque facial shadows will result and larger than life shadows will be cast on the wall. Unless you're shooting at a very slow speed, don't mix flood and flash—they won't help each other.

Now, get down at a child's-eye-view level and vary your shots at long, medium and close range.

In addition to creating more flattering and less contrasty lighting, these techniques will help prevent discomfort and keep your volatile subjects at ease. ★ ★ ★

PRINTING PRESS

(Continued from page 152)

with a block of hardwood, cut to size. In other forms of printing, where the steel roller is used, linoleum or plates should be mounted on blocks $\frac{3}{4}$ in. high or higher.

Before printing, the top roller must be adjusted to the height of the printing block or form, and to the pressure required. The block is then padded with more or less packing, as required. First, the printing paper is laid on the inked block, then a sheet of manila or tympan paper (available from printing supply houses) is laid over it, followed by five or six sheets of newspaper. This is topped off by a sheet of thin cardboard to prevent the paper padding from bunching and creasing under the roller.

This same amount of padding should be placed on the adjusting blocks and both adjusting screws tightened down until they cannot be turned further. Then back off both screws a full turn and try the printing block (padded but uninked) under the roller. Any further adjustment of the roller is done equally at both ends by turning each pressure screw the same amount.

Checking roller pressure

Usually, not much more pressure is required than enough to make the top roller turn by friction as the form is fed through the press. Further adjustment is determined by inking the block and pulling proofs on newsprint. Examination of the proof will show whether more ink or more pressure (or less pressure and less ink) is required. This judgment comes with experience.

To operate the press, start turning the star-wheel, and at the same time push the form against the roller. Turn the wheel rapidly, without hesitation, until the form has completed its pass.

Inspect the print before stripping it from the block. If the image is lighter on one side than the other, the rollers are not parallel. However, the print can be saved by turning the block around and running it through the press again. The roller can then be adjusted by turning down the screw on the light side. When the press is adjusted, the locking nuts are run down on the pressure screws.

Once adjusted for a given block, the press is adjusted for all future blocks of the same height. Where small increments of adjustment are involved, the pressure can be regulated by adding or removing a sheet or two of the newsprint packing, as required. ★★

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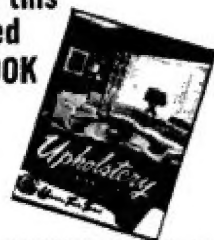
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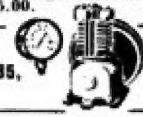
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Petroleum Production Engineering
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Pipeline Engineering

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Domestic Heating with Oil & Gas
Domestic Refrigeration
Heating
Heating & Air Conditioning with Drawing
Industrial Air Conditioning

Industrial Heating
Plumbing
Plumbing & Heating
Practical Plumbing
Refrigeration
Refrigeration & Air Conditioning
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Paper Making
Pulp Making
Pulp & Paper Engineering
Pulp & Paper Making

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Sales Management
Salesmanship

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Shorthand
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Machine Shop Practice
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Toolmaking
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Textile Technology
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